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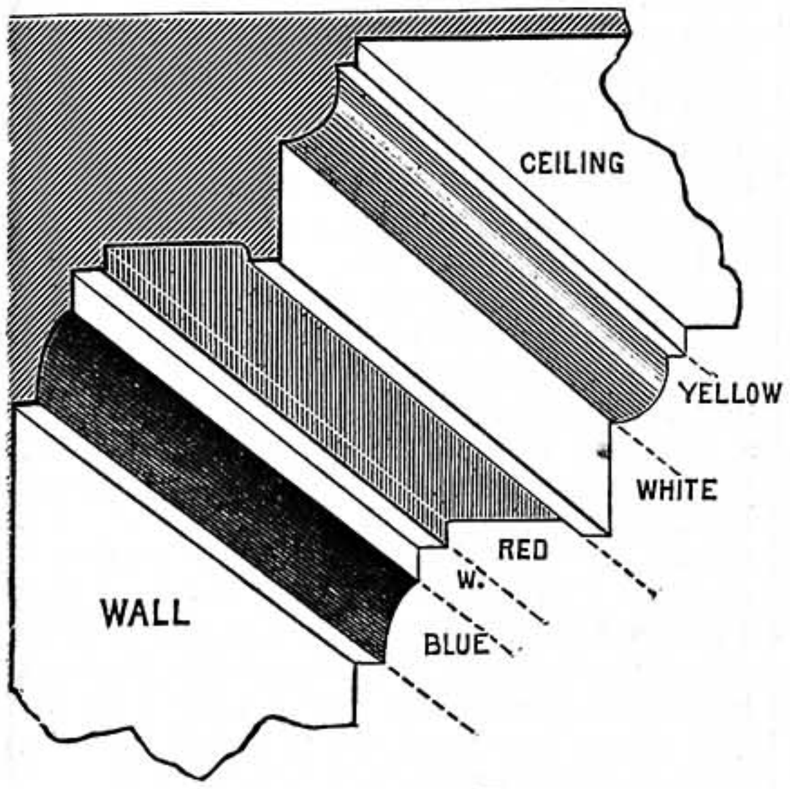


Fig. 1.—Primaries applied to Form on Owen Jones's Principle.

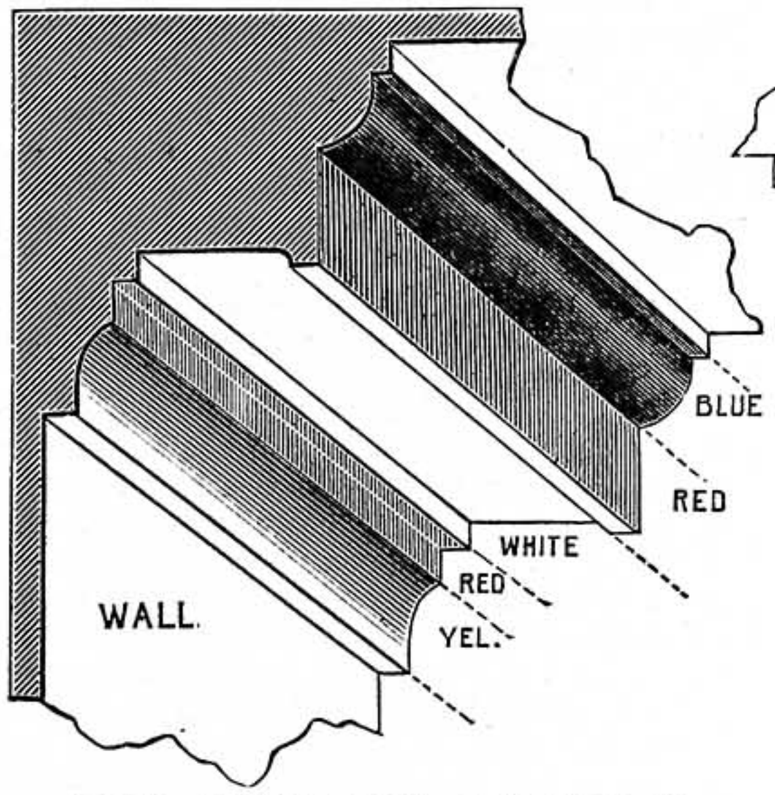


Fig. 2.—Positions of Primaries reversed.

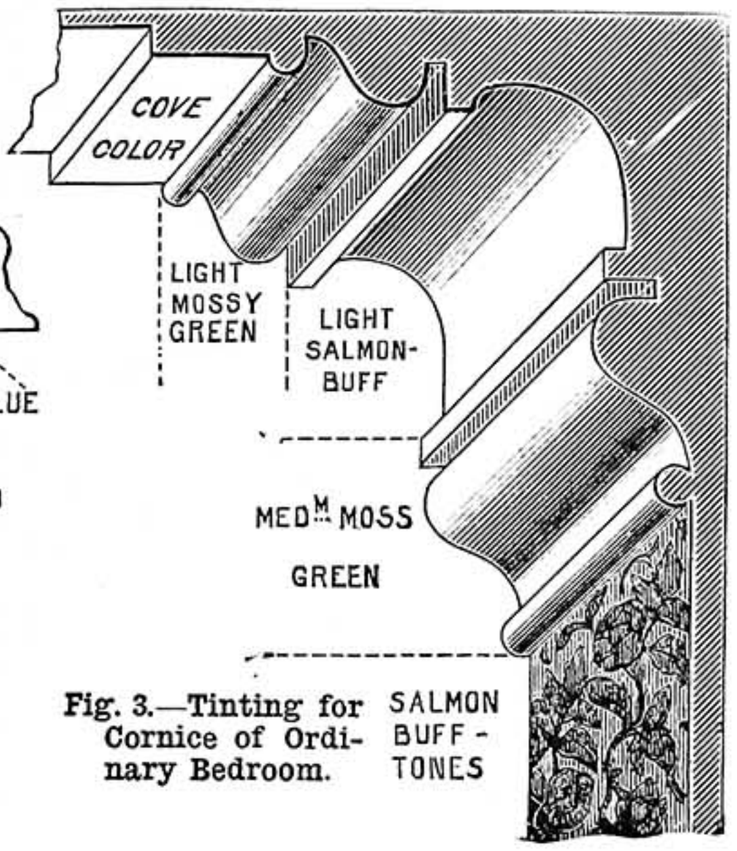


Fig. 3.—Tinting for Cornice of Ordinary Bedroom.

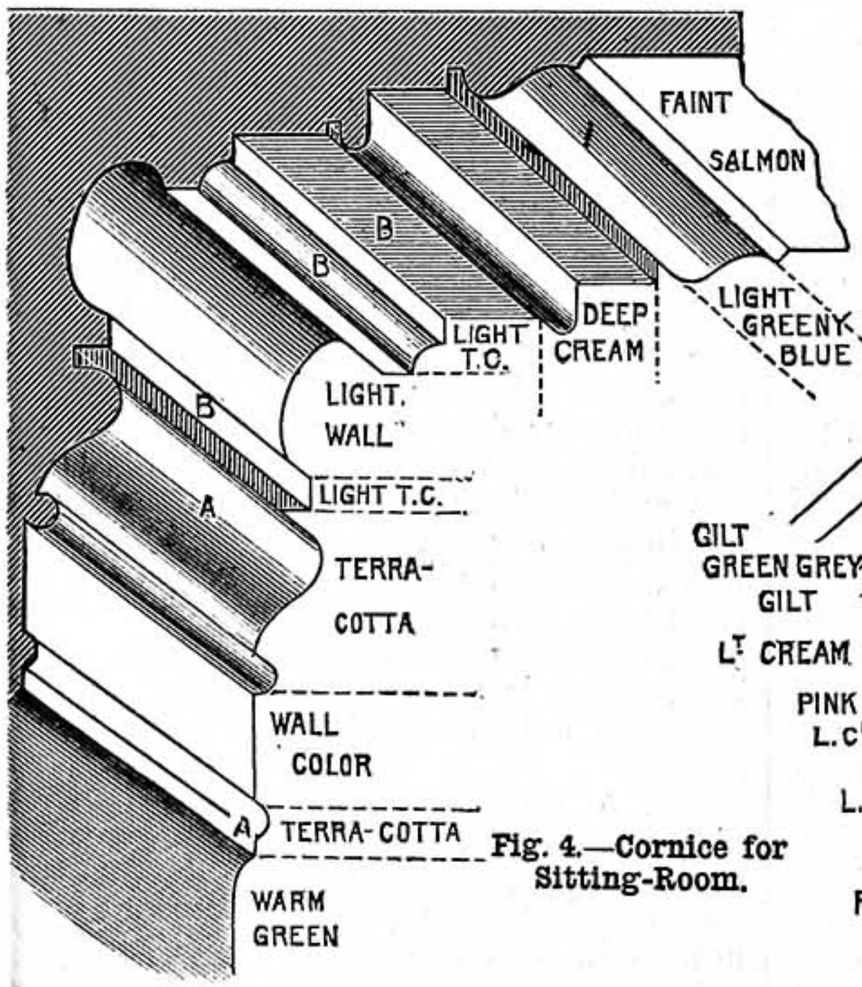


Fig. 4.—Cornice for Sitting-Room.

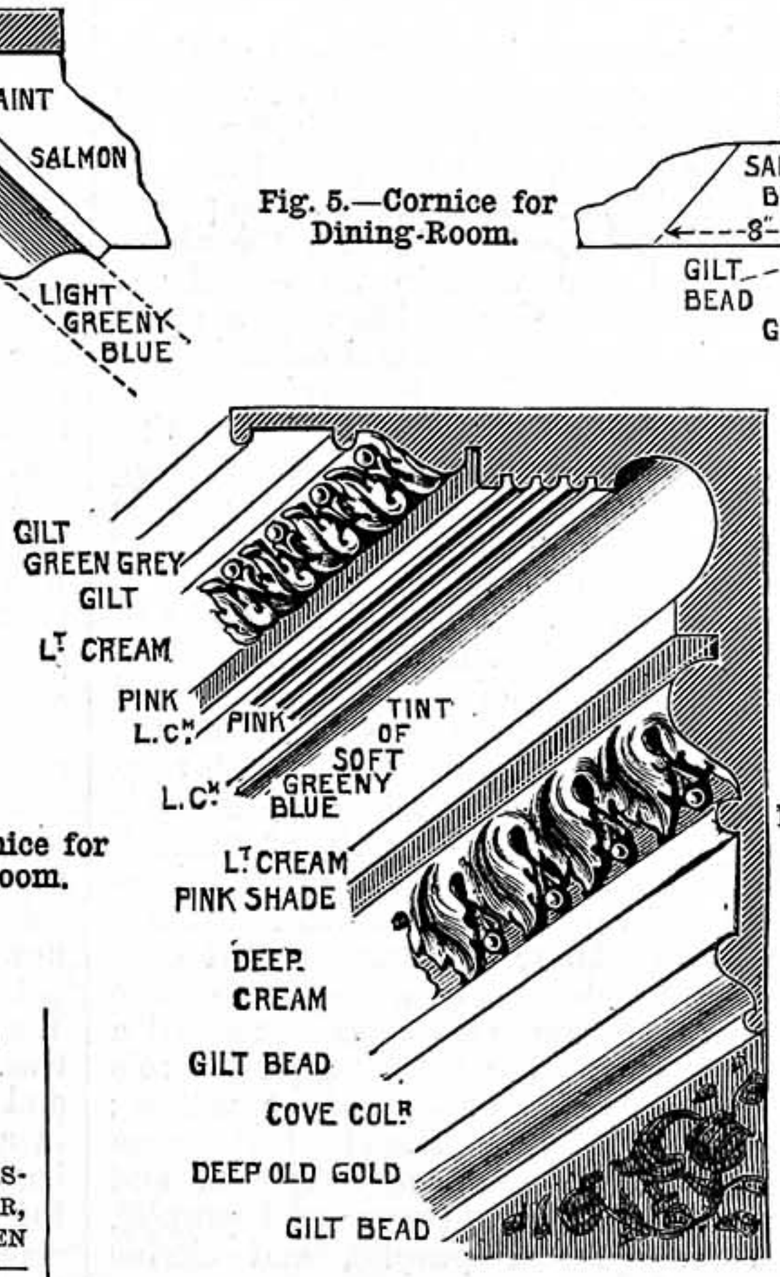


Fig. 5.—Cornice for Dining-Room.

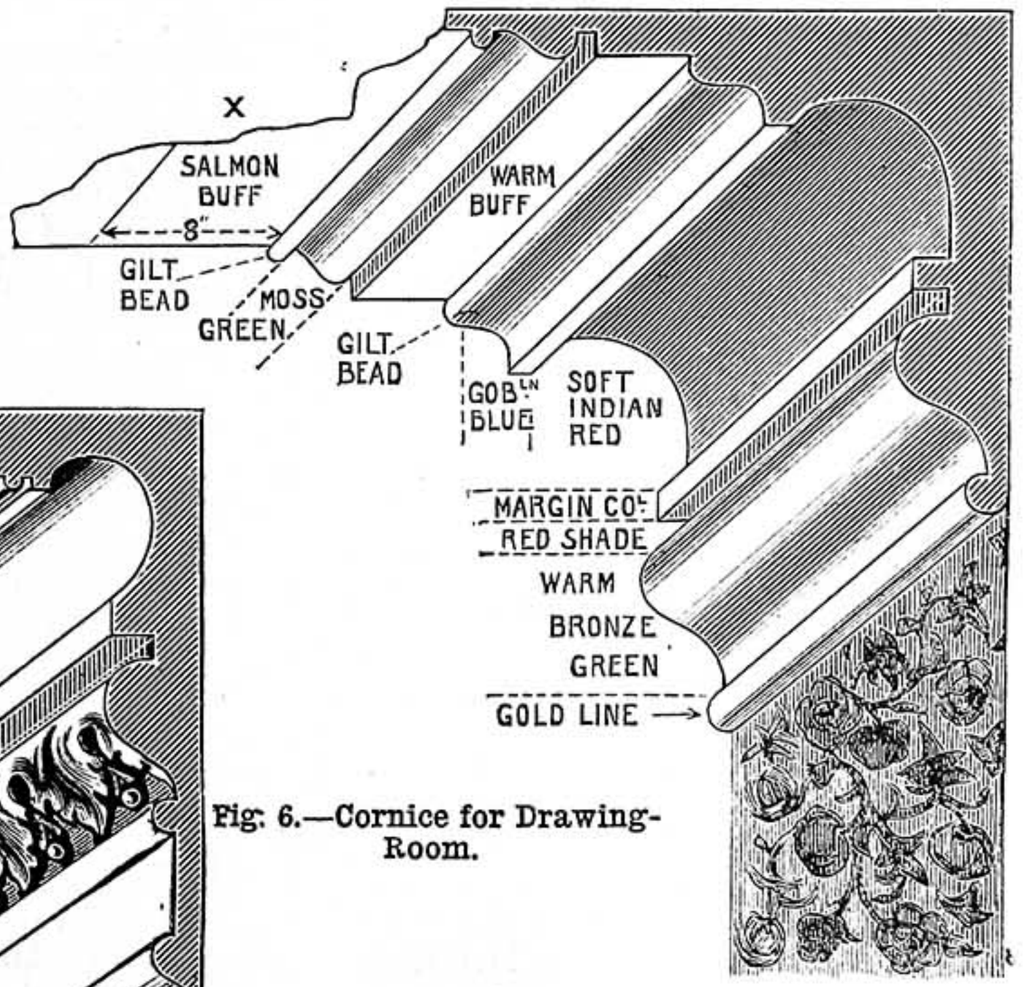


Fig. 6.—Cornice for Drawing-Room.

ON COLOUR APPLIED TO FORM.

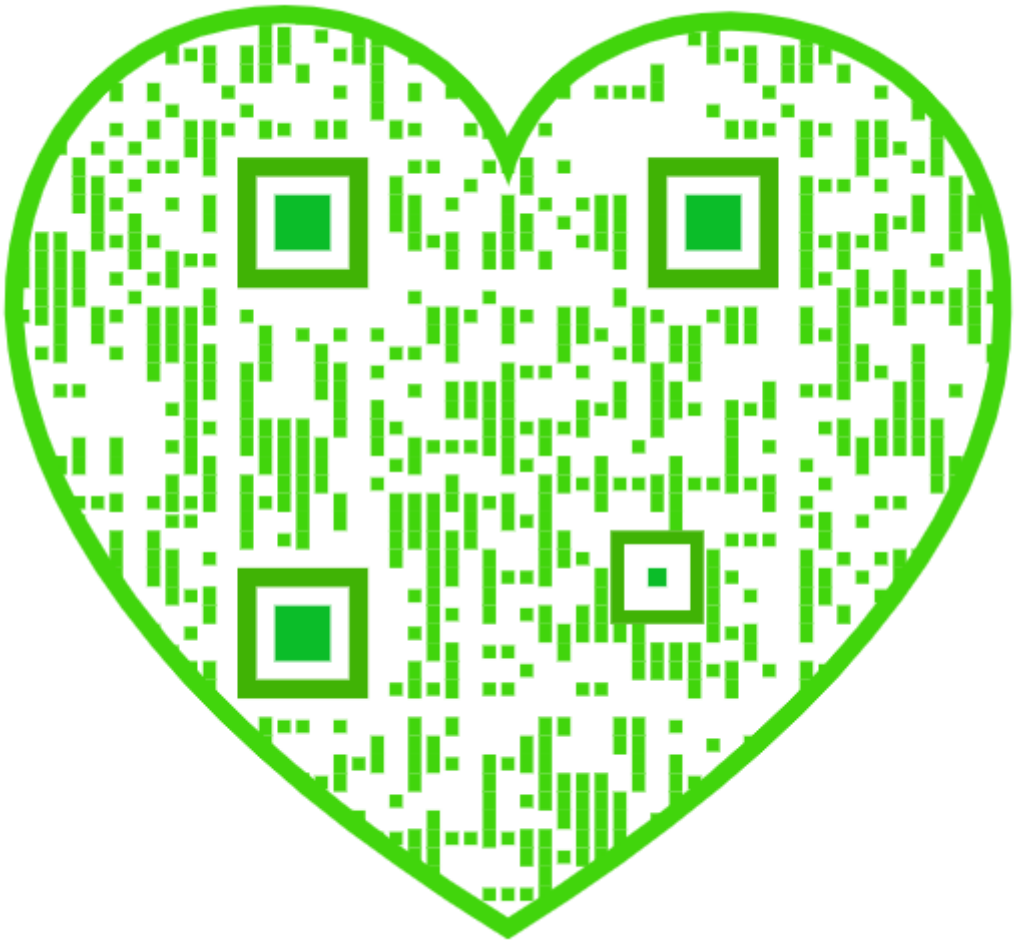
BY FREDERICK PARSONS, F.S.SC.

INTRODUCTION — TINTING THE CORNICE — ELASTICITY OF TERM—INDIVIDUAL TASTE—COLOUR, A SCIENTIFIC AND ARTISTIC SUBJECT—OWEN JONES ON COLOUR—RUSKIN ON COLOUR—CHROMATIC EQUIVALENTS OF CHEVREUIL AND FIELD—EXPRESSIONS OF PRIMARY COLOURS—CORNICES ON OWEN JONES'S THEORY—SUGGESTED TREATMENT OF BEDROOM CORNICES—CORNICE FOR DINING-ROOM — CORNICE FOR DRAWING-ROOM—GENERAL RULES FOR TREATMENT OF CORNICES.

Let not the intelligent reader start, nor his countenance grow troubled, on seeing my head-line, since the purpose of this paper is both a simple and practical nature. No mystical theories of "luminiferous ether" or "wave-lengths" are about to be considered; nor am I desirous to "trot out" those items of interminable discussion—the ancient polychromatic treatment of classic statuary, or the truth and beauty of mediæval applications of colour to stone mouldings, tracery, and panel-work. Those who want a strong dish of "scientific colour" must turn to the recent works of Professors Ogden Rood or A. H. Church; whilst it would ill become one to consider in WORK the latter aspect of colour applied to form—"the form divine"—when all the skilled and learned Fellows of the "R.I.B.A." are fervently enthusiastic in their divided opinions.

"The cornice to be tinted to match." This is a harmless-looking sentence that appears on nearly every specification of modern house and decorative painting. There are many readers of this paper who, doubtless, "could a tale unfold" concerning that apparently simple operation which, if not so harrowing as that related by the ghost in *Hamlet*, would so reek of worry, nervousness, and mortification of spirit that they here greet with gladness any attempt to explain the practical aims and methods by which this tinting of cornices is successfully governed.

It is a remarkable fact that, whereas even



ten years back tinting to plaster cornices was seldom undertaken beyond the reception-rooms, nowadays it is common, in all the chief centres of trade, to every decent bedroom of a house of any pretensions. The great expansion of our notions of home and industrial art has chiefly accounted for this; but a greater stimulus has been directly derived from the "fashion"—educated demand—for the beautiful effects of *colour* that is now current. Instead of the old orthodox "grey-satin" wall-papers, with their white-washed or "water-wave" papered ceilings, we have "blue bedrooms," "red," "old gold," or all these primary tones combined in one design of wall-paper; whilst the ceilings have ornamental designs to correspond in paper-hangings, or are distempered in a decided tint of pink, cream, or blue. To leave the cornice white, or even the same as the tint of ceiling, looks altogether weak and poor; and here it is that the worker, unless he has both colour ability and experience to guide him, often finds his peace of mind forsake him.

This "tinting," as applied to plaster cornices, is a somewhat elastic term. It may mean the application to the whole of its members of one general "tint" of colour with white, or the addition to this of a few beads and lines of positive colour; or it may be further interpreted as colouring the cornice with various and many colours and tones, to harmonise with or contrast the wall or ceiling decoration.

Now, when a woman—or the average woman—chooses a coloured ribbon or dress material, she is usually guided in that choice by her own individual "taste." This selection by "taste" is in many respects a very curious phenomenon. "I know what I like!" is usually the sole justification of colour choice. If one were to inquire the why or wherefore of the decision, the only resource that avails is "Taste—my taste!" Should the object of discussion be a carpet, curtains, or wall-paper, we usually find the same operative power in force. So long as one person's colour "taste" has but to please the author of it, this kind of irrational and irresponsible selection may work very well; but if the *decorator* desires to conceive a scheme of colour that shall stand criticism and merit general approval, he must work on totally different lines.

Colour is, in itself, both a scientific and an artistic subject—scientific, for instance, in its dependence on and relation to the sense of vision; and *artistic* in that its effects are capable of "individualism" in manipulation, and of conveying definite sensations and emotions of truth and beauty from the mind of the colourist to that of the beholder. We may fairly class the art of the colourist upon the same level as the art of the musician. What, therefore, should we think of any person's "taste" in pianoforte playing which simply consisted of strumming haphazard certain strings, without any regard for or knowledge of the laws of harmony and concord? And yet this is, if anything, a less questionable matter, since that instrument gives us *fixed* tones, while with colour we have no similar permanent scale to work upon. One would further imagine, judging from every-day experience, and an occasional dip into the "Home Art" column of a Society paper, that "colour taste" is inherent in nearly all human nature. If that is to be seriously accepted as a correct standard of selection, we can only rejoin by pointing to the interesting inhabitant of the Cannibal Islands, whose physical palate, according to this argument, is equally a natural and "good taste," since it is "his taste."

Notwithstanding forty summers have come and gone since John Ruskin, and that eminent architect and decorator the late Owen Jones, boldly controverted each other's teachings on the relation of colour to form, the force and application of their "old-time" contentions are still to-day of much interest and value. We will, therefore, briefly consider those conflicting arguments, and endeavour to see how far they supply a basis for practical work, such as tinting cornices and other simple decorative arrangements of colour.

The Marlborough House lectures of Owen Jones, given in the year 1852, contain this dogma or proposition:—*Colour is used to assist in the development of form, and to distinguish objects, or parts of objects, one from another.* In general support of this, the lecturer referred to Nature, and pointed out the difference in colour between flower and stalk, the appearance of earth and sky, and of the hair, eyes, etc., of the human figure.

Mr. Ruskin's theory, which he also deduces from the observance of natural colour, is that colour never follows form, but is arranged on a totally different system. He argues—"What mysterious connection is there between the shape of the spots on an animal's skin and its anatomical system? The stripes of a zebra do not follow the lines of its body or limbs, still less the spots of a leopard;" and in sequence to these and other natural examples he concludes—*that the first great principle of architectural colour is this: let it be visibly independent of form.*

Although even a bare statement of these two diverse conclusions should be valuable to all young students in architectural or decorative colour, I do not intend here to further explain or analyse them. The period of time that has elapsed since the above lectures and that wherein we record our own humble experiences has shown much progress in decorative art and colouring, so that modern conclusions concerning the relationship of colour to form are now on this wise:—*That the two systems, whilst being quite distinctive and separate, may be so combined as to materially enhance the beauty and effect of both.*

Now, let us assume, for the purpose of practical illustration, that the early chromatic equivalents of M. Chevreuil and George Field are correct—viz., that the *primary*, or first, colours are pure red, pure blue, and pure yellow; that each primary is contrasted harmoniously with, or neutralised by, a mixture of the two other primaries in certain proportions, which mixture is named a *secondary;* and further, that each secondary is balanced by a certain mixture of the two remaining secondaries, termed a *tertiary* colour. The total purport of this is, therefore: *primaries*—red, blue, yellow; *secondaries*—purple (red and blue), green (blue and yellow), and orange (yellow and red); *tertiaries*—olive (green and purple), russet (orange and purple), and citrine (orange and green).

The *expressions* of the primary colours—that is to say, the main impressions they convey to the mind through the vision—are, briefly, as follows. Red gives richness and warmth of sentiment, and appears stationary of position when applied to form. Blue speaks of space and coolness, and will give a retiring effect to form. Yellow conveys several sensations, and is most difficult to successfully manipulate: we consider it chiefly an exciting power, which may verge from high brilliancy and lustre to very gairish and irritating effects. Beyond this, in its application to form, yellow has a prominent or advancing appearance.

Here let us turn to Fig. 1, representing the section of a cornice used by Owen Jones to explain his theory. Red is placed in the shade to soften its brightness; yellow is put on the most prominent form to assist its shape; blue in the concave moulding. White intervenes between them on the vertical planes, to prevent one primary impinging on the other. This, it must be pointed out, is really but applying to mouldings the colours best adapted to displaying their shape; it does not secure colour harmony of the cornice in itself, much less of cornice with the supporting wall. We get an idea from Fig. 2 how far colour (represented there by shade) does assist form. At Fig. 1 we have them as above-mentioned; at Fig. 2, the colours reversed. *Colour harmony* is still independent of either arrangement.

At Figs. 3 and 4 we consider the tinting of ordinary bedroom and sitting-room cornices, respectively. The first of these assumes a bedroom of cold aspect, the walls hung with a paper in "self-tones" of light salmon-buff, the ceiling-flat being distempered a warm cream—white with *raw terra-di-sienna*. The mouldings next to the paper I put a warm, "mossy" green, made from ochre, umber, a little *ultramarine green* (a blue of very green hue), and a little white. The green hue must be very subordinate, since the warm walls will bring it out fully. In the cove I put a light tint of warm colour, which, by reason of the shade, will look a little deeper; this also is used on the flat A, next cornice. The mouldings between cove and flat are a lighter tint of the moss-green made with the latter, and the ceiling cream-colour. If handled with care and judgment, the result will be harmonious and effective with simply three tints of colour. The other example (Fig. 4) provides a neutral, or "warm," green, flatted wall-colour. Next to this we put a soft terra-cotta, or reddish-brown, a few shades darker than the wall; above this a band of wall-colour, and this framed by the previous terra-cotta at A and a lighter shade at B. The cove we put in a lighter and more yellow tint of the walls, bounded also on top by the lighter terra-cotta tint. A deep-cream flat comes next, then the ogee in a light tint of greeny-blue, which is separated by a small cream flat from a light and soft salmon-tint on ceiling.

Fig. 5 represents colour applied in a dining-room over a rich and glowing wall-paper of semi-natural floral design, the colours being warm greens and browns, with flowers in mixtures of soft, rich red, old gold, and a little "gobelin" or greenish-blue. We give the ceiling a soft but decided pink tint, made with Venetian red and ochre, and put an 8 in. margin, next to cornice, in a deeper shade of ceiling colour. The base of cornice is a medium bronze-green, the cove Indian red and a little white—deeper than the base in tone. The margin colour of ceiling is put on the flat above at X; a medium tint of soft gobelin blue at the flat and hollow next to the cove, and the remaining members warm buff and a greenish-yellow or light mossy green. The lines and ornament may be in terra-cotta, moss-green, and light gobelin blue upon the light pinky-buff of ceiling. In this section the place for a little gilding is indicated.

Fig. 6 is a treatment for a drawing-room having straw-cream ceiling and old gold

walls in self-tones (or monotones) of that colour. The blue cove tint, though appearing blue against a faint yellow and cream, is, when viewed alone, quite a green tint. The very faint pink reed-colour is a tint of Indian red. The creams are made with chromes and umber, and must not be at all irritating.

I do not wish to imply by this lesson that any worker who attempts to follow my directions will be sure to get the best results. He must have a mind that is sensitive to harsh or crude sensations, and that can avoid them. Beyond this, when dealing with the individual client, we may have to consider his or her colour-idiosyncrasy, which often exists in a natural dislike of one particular colour. In all cases, let the cornice *in its entirety* frame the ceiling. Let the darkest colour be at the base, and lighten up to the ceiling; but always get the deepest tones darker than the general wall-colour. In mixing distemper tints, accustom the mind to judging the effect of a colour when dry. Avoid all plain tints of white with pure red, blue, yellow, green, etc. Make up the various tones of colour in the pots; then put a little red into green, green into red, etc., until they are sufficiently soft and neutralised to give a restful and harmonious combined effect. Do not fritter time away in putting twenty colours and shades into one cornice; the client cannot appreciate it, and it is lost to ordinary view, besides destroying the breadth of the cornice. Never put gilding save on advanced portions, and always finish it off with a coating of clear size.

THE VIOLIN: HOW TO MAKE IT.

BY J. W. BRIGGS.

NECK AND SCROLL—BLOCK FOR NECK—MARKING OUT—CUTTING OUT—TRACING SCROLL OUTLINES—CARVING SCROLL—FINGER-BOARD—CUTTING PEG-HOLES, ETC.—GLUING ON FINGER-BOARD, NUT, ETC.—CUTTING SHOULDER—FITTING NECK TO BOX—ROUNDING AND GLUING UP NECK—VARNISHING AND VARNISHES—FINISHING—SETTING SOUND-POST, STRINGING, AND SCREWING UP.

Neck and Scroll.—The neck is next wanted, and I will try to tell you how it should be made; but as regards the scroll, I fear you will have to depend more on your eyes and the patterns than on any description which I can possibly give. By all means have a good neck and scroll near you for reference and guidance.

Block for Neck.—The block from which the neck is made is a piece of sycamore $10\frac{1}{2}$ in. long, 2 in. broad, and $2\frac{1}{2}$ in. deep. The 2 in. side should be that nearest the bark of the tree. Plane this side true, and it shall be called the "face." Next plane both $2\frac{1}{2}$ in. sides true and with the same bevel from the "face," and saw one end square off. The block, when ready for use, should be $10\frac{1}{2}$ in. long, $2\frac{1}{2}$ in. deep, and $1\frac{7}{8}$ in. on the face side, with an end section like Fig. 17. It will be convenient at this time to make a centre line along the face, square it down each end, and continue with a straight-edge along the under side. If you are fortunate enough to get a piece 2 in. wide both top and bottom, your labour will be considerably reduced, as it will be much easier to make true or square cuts.

Marking Out.—I have assumed that Fig. 18 will be cut out, as well as preceding patterns, in zinc or thin wood. Your neck block being now ready, lay the pattern Fig. 18 on the block, and trace round it with the marker, pencilling afterwards; next square the line A A^2 across, and, $\frac{25}{32}$ in. from the top of this line, square from the end of the block the line B B^2; the intersection of these lines gives the proper position, or centre, from which to describe the eye of the scroll, which is done with the compasses opened to $\frac{5}{32}$ in., and making a circle from this centre. Three-quarters of an inch from A the line E E should be squared across. From a point midway between A^2 and B and crossing the centre draw line C C^2, and from midway between A^2 and B^2 draw line D D^2; now prick through the dots on the lines in the following order: A, C, B^2, D, A^2, C^2, B, D^2, and then through the second or outer dot on A. When a proper curve is drawn between each of these dots, the outline of the spiral is complete. Now square lines across the face at F H, and $5\frac{5}{8}$ in. from F the line I.

Cutting Out.—The outline may be cut out by a narrow band saw; for a few pence a sawyer will do this, and it is much safer than the bow saw. If the neck is being made from a piece like Fig. 17, a piece of deal, sufficiently thick to make the unmarked side lay square on the saw table, had better be glued on. After being sawed out, remove the remnants of the strip, and mark this side in a corresponding way to the other side. The centre marks will have been partially taken out by the saw, and the line must now be continued all round the head from F to G. Now square a line across the back at G. With the compasses open $\frac{3}{4}$ in., set out that distance each side of the centre line at I; close the compasses to $\frac{7}{16}$ in., and mark so much off each side of centre line at F, and with a pencil and straight-edge make a line over the marks on each side, but extend them to E. The sides thus marked out should be sawn down, and then cut square off at E.

Tracing Scroll Outlines.—Trace the scroll outlines, Figs. 19 and 20, in their places, as marked on the patterns. Open the compasses to $\frac{3}{16}$ in., and draw them down each side of the head from the end of line C to F; one point of the compasses will be at the side, and the other will mark out the cheeks of the peg-box, which, being thus described or marked, should at once be cut out with gouges and chisels. When this has been done, file the cheeks clean and square. Now fasten the neck edgeways in the vice, and with a dovetail or fine tenon saw cut down just outside the lines K K, L L, M M, N N, but not so deep as to cut into the lines marked from Figs. 19 and 20. Next saw at right angles with these cuts, and along the marks made from Figs. 19 and 20.

Carving Scroll.—The rough wood is now taken off, and with gouges of various shapes you should now be able, constantly referring to your model, to make a respectable scroll for an amateur. Accurate manipulation of the carving tools is not the only requirement before a good scroll can be made; a cultured eye is essential. When the scroll is carved, the head should be scraped and sand-papered, and thoroughly sponged over with cold water; this will throw up the defects. When it is quite dry, gauge, with the compasses opened $\frac{1}{16}$ in., lines all round the head and scroll. Between the gauge mark and the centre line, from G round to C, the hollows should next be carved. With a fine file bevel off the edges all round the head and scroll as far as the compass lines; now carefully sand-paper all over, leaving the edges of the bevels quite sharp.

Finger-Board.—The ebony finger-board—which, of course, you will buy ready made—should next, with the veneer plane, be planed true on the flat side, and have a centre line marked along it. The "face" of the neck should also be toothed over with the same plane, and the centre line be freshened up.

Cutting Peg-Holes, etc.—Place the neck pattern (Fig. 21) flush with the neck and to the marks F and I, and trace firmly the lines O O, P P P, and also make the four dots where the peg-holes will have to be bored. Repeat the process in corresponding position on the other side of the neck, and with tenon saw cut down O O, keeping square across centre mark at I. Now square the centre line down the face thus cut.

Gluing on Finger-Board, Nut, etc.—The finger-board should now be glued on (use only two or three drops of glue, as it must come off again before the fiddle is varnished), with the centre line coinciding with that on the neck, and the narrow end of the board touching the line H. The board being cramped fast with hand-screws, the nut should be glued on. It is a piece of ebony $\frac{1}{16}$ in. deeper than the thickest part of the narrow end of finger-board, $\frac{3}{16}$ in. wide and $\frac{15}{16}$ in. long. Both nut and board being quite set, which they will do much more rapidly if made hot before they are glued, put the neck, board downwards, in the vice, and cut just outside line P P P with the bow saw. This done, file down to the line, using a small straight-edge to try the evenness of the neck, between the curves.

Cutting Shoulder, etc.—Remove the neck from the vice, and place the shoulder pattern (Fig. 22) with the top side close under, and even with the edges of the finger-board, and mark down both sides and across the bottom of pattern. With a gouge, followed by broad chisel, cut to the lines last made, and also across the bottom at T (Fig. 21); along this face the centre line should next be squared. Fasten the neck in the vice, and cut off the parts which project over the finger-board, and with files make both the neck and nut even with the finger-board.

Fitting Neck to Box.—If the instrument has been made true to the lines, there will not be much difficulty in fitting the neck. Place the neck with its back centre mark on the joint of the "tab" and the centre line of shoulder, coinciding with the joint of the belly. With a sharp knife make cuts *slightly narrower than the shoulder* in the end of the belly, and remove the neck. Extend the cuts to the inner edge of the purfling; lay a small straight-edge along the purfling, and cut out the rectangular piece of the belly between the shoulder-marks. Again put the neck in position, and with a very fine point trace the sides of the shoulder on the ribs, and cut through these lines into the block. With a $\frac{5}{8}$ in. chisel cut the block down to the belly, proceeding very carefully, frequently trying the neck until the true position is obtained. This must be tested by looking along the sides of the finger-board and between the sound-holes, up the back joint and along the centre line of the head, and along the edges of the back, with which the eye of the scroll should be in line. Now mark the shape of the tab on the back of the shoulder.

Rounding and Gluing up Neck.—The neck should next, with gouges, rasp, and files, be rounded to a rather oval shape

(for which I never use patterns), and thoroughly sand-papered. When this is done, it is the best time to bore the peg-holes, with a $\frac{3}{16}$ in. bit, from outside each cheek, with a wedge or block inside the peg-box to make it solid. Now run the taper bit through the holes as a finish. The holes nearest the finger-board should taper from left to right, the next two from right to left, and so on. Now "size" the shoulder, and glue the neck in its place. In a few hours wash the fiddle over to remove all glue and dirt, and when dry, finish the "tab" and give a final course of sand-paper, and the violin will be finished in the "white." It is hard to resist the temptation to string the fiddle up in this state, but to do so would cause a great deal of labour, so you had better remove the finger-board and get ready for varnishing the instrument.

Varnishing and Varnishes.—It is not my intention to enter into a disquisition on varnishing. Should the reader wish to study the question for himself, he has any amount of opportunity offered for doing so; and, in experimenting, he has a good chance of disposing of his surplus capital and spare time. Amongst the works offered for his assistance are those of Davidson, Otto, Hart, Savart, and others, as well as in Mr. Fleming's very readable book, "Old Violins." But I confess that nobody has impressed me so much as the late Charles Reade did in his letter which went the round of the newspapers some years ago. Whenever I have varnished a fiddle in the way named below, it has always been most satisfactory. It would be an impossibility for anyone to begin to varnish a fiddle without being compelled afterwards to make some experiment or other.

Placing a small quantity of Howard's essential oil of turpentine in a cup, I put the latter in a water bath on the gas stove, and, at a very gentle heat, dissolved as much gamboge as the oil would take up, and then laid a coat on the violin. In three hours, the first coat being dry, another coat was given of the same varnish. Two days afterwards the varnish was quite hard—a beautiful yellow; the grain had not risen, and was quite bright. Having a good foundation, I put coat after coat of varnish, composed of the saturated alcoholic solutions of dragon's blood, sandarach, and benzoin (rubbing each coat down with a piece of oiled felt), until the varnish was quite solid and brilliant.

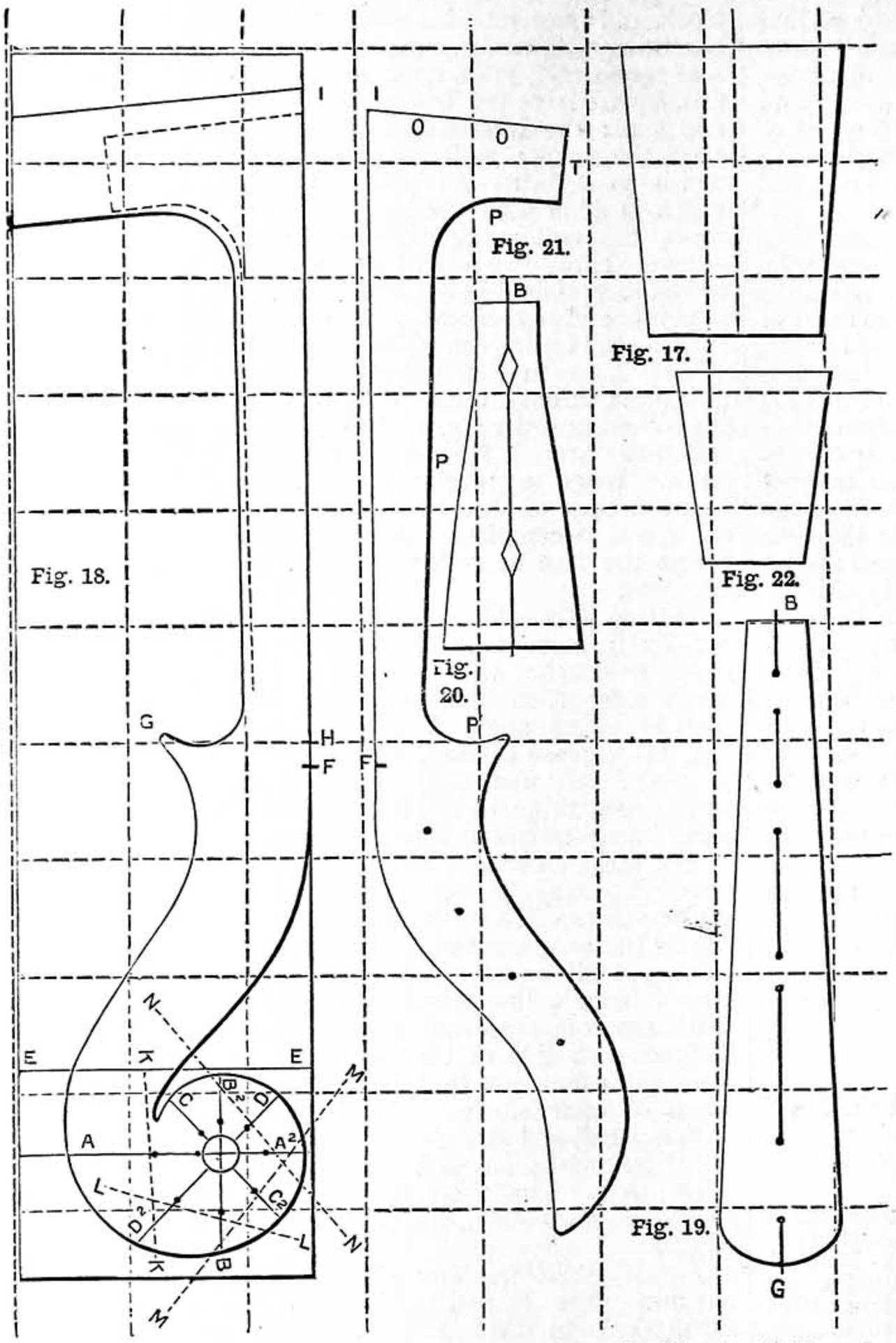


Fig. 17.—Section of Block for making Neck and Scroll. Fig. 18.—Pattern for making Neck and Scroll. Fig. 19.—Outline of Head (Back). Fig. 20.—Outline of Head (Front). Fig. 21.—Pattern of Neck. Fig. 22.—Pattern for cutting Bevel for Shoulder. All the above Figs. are half size, and divided into Squares for Enlargement to full size.

There are on the shelves in my work-room the saturated solutions of mastic, dammar, elemi, sandarach, benzoin, myrrh, dragon's blood, Socotrine aloes, Barbadoes aloes, gamboge, annato, seed lac, sandal-wood, saffron, Venice turpentine, etc. Appended are a few recipes for making varnish, which have been gathered from various sources.

(1) Dissolve in oil of rosemary as much clear copal as the oil will absorb. If too thick, use spirits of wine to dilute.

(2) Essential oil of turpentine, 8 ozs.; drying linseed oil, 4 ozs.; fused amber, 4 ozs.; gum lac, 1 oz. Dissolve by heat.

(3) Dissolve by heat 8 ozs. of copal in 1 pint of drying oil, and use oil of turpentine as a diluent.

(4) Make a strong alcoholic solution of sandal-wood or other colour desired, and concentrate this solution by evaporating it to half the bulk. Mix the solution with essential oil of turpentine, and evaporate all the spirit by boiling in a water bath. To each gill of coloured essential oil add in turn, as dissolved, $1\frac{3}{4}$ ozs. of mastic, 1 oz. of dammar, and lastly, 1 oz. of linseed oil. This varnish should not be used until three or four months old.

(5) *Spirit Varnishes:* Gum elemi and mastic, $\frac{1}{2}$ oz. each; sandarach, 2 ozs.; Venice turpentine, 1 oz.; seed lac, 1 oz. Dissolve in 12 ozs. of methylated spirits which has been coloured to suit.

(6) Colour 1 pint of methylated spirit or wood naphtha to suit, and add the following: 2 ozs. of mastic, 1 oz. of seed lac, $2\frac{1}{2}$ ozs. of juniper, and 1 oz. of Venice turpentine.

(7) Three ozs. of shellac or seed lac, 3 ozs. of sandarach, 1 oz. of mastic, 1 oz. of benzoin, to each pint of coloured spirit.

Finishing.—The fiddle should be varnished, with the exception of the "handle" part of the neck, and when it is perfectly hard—not before—it will be ready to have the neck cleaned; which done, glue the finger-board on the neck again—this time quite fast. When it is set, wash all dirt and glue from the neck, and polish it up with the finest sand-paper and linseed oil; but mind that the varnish be not injured in doing this. With a fine "rat-tailed" file cut in the nut the four grooves in which the strings are to lay. Mark the positions of the outer grooves $\frac{1}{4}$ of an inch from each end of the nut, and, with the spring dividers, divide the intervening space into three portions. Make all the grooves free from sharp edges, as these would cut the strings. Free the peg-holes from varnish, and file a set of pegs to fit. The bridge should be fitted to its position: between the V's of the sound-holes. No. 1 gouge will be about right for cutting the feet. The top of the bridge should have nearly the same curve as the finger-board, but should be about $\frac{3}{16}$ in. higher than the place at which a line along the top of the finger board would terminate if extended to the bridge. The bridge will also need to be made a trifle thinner towards the top. Make four very shallow grooves with the file: these are for the strings to lay in. Fasten a piece of

Fig. 23.—Violin finished and strung.

strong gut into the tail-piece, of such length that when the loop is placed in the groove of the end pin the tail-piece is brought close to the bottom nut or rest.

Setting Sound-Post, Stringing, and Screwing up.—The sound-post should now be set in position; but, as remarked in the earlier part, there may be some difficulty in deciding which is the best place for it, and this can only be tested when the instrument is strung up. This can now be done. First, put the fourth or G string in the left-hand "slit" of the tail-piece, and through the peg nearest the finger-board; the first or E string is the next in order, then the third, and lastly the second string. Whilst the strings are quite slack, set the bridge in position, and screw the strings steadily up to pitch, alternately fourth and first, second and third, meanwhile observing that the bridge does not pull forward. Now, how do you like the tone? Of course everyone will remark, by way of encouragement, that "it is all right for a new fiddle," or "the tone is rather raw, but it will improve in two or three years." These observations are as certain as the stereotyped ones about the weather.

I do not know what other people may feel, but to me it was a moment of intense pleasure when I heard the first note from my first fiddle: exceeded, perhaps, when I heard the voice of double bass No. 1. This I was so anxious to do that it was strung up in the "white"—a mistake that will not occur again.

SUBSTITUTE FOR HALL-STAND.

EASILY AND CHEAPLY MADE.

BY B. R. CONDER.

AIM OF DESIGN—MATERIAL AND COST—HAT-STAND: DIMENSIONS AND CONSTRUCTION—DECORATION—MIRROR—DIMENSIONS AND CONSTRUCTION OF UMBRELLA-STAND AND CUPBOARD—TRAP-DOOR.

I PURPOSE describing briefly in the following paper two very easily and cheaply made, and yet thoroughly efficient, substitutes for a hall-stand. In planning them I aimed chiefly at economy of pence, and therefore of material, simplicity of construction, and consequent economy of time in making, and compactness. At the same time I was desirous to some extent that they should be ornamental, or, at least, not absolutely unsightly.

For the cheapness I can answer, as the entire cost of material—wood, paint, brass hooks, and mirror—did not exceed 8s. They are made of deal, and painted with Aspinall's black enamel; as, however, so little wood is required, the cost would not be greatly increased if, instead of deal, some ornamental wood, such as oak, mahogany, or walnut, were used.

The construction of the hat-stand, which we will consider first, is very simple, and a very short description of it will suffice.

Its dimensions are: extreme height, 2 ft. 6 in.; and width, 1 ft. 11½ in. It consists of an outer and an inner frame, which are mortised together. The four pieces forming the outer frame are 2½ in. wide and 1 in. thick, and their edges are stop-chamfered, as shown. The horizontal rails are mortised into the upright ones, 2½ in. from the ends of the latter, the tenons being carried about two-thirds of the way through. The parts of the inner frame

Fig. 1.—Hat-Stand of Rails with Mirror.

are 1½ in. wide, and only ¾ in. thick, so that, when fixed in place, their faces are flush with the inner chamfered edges of the outer frame, and both frames are flush at the back. They are mortised together and into the outer frame, in such a manner as to leave a space in the centre 9 in. high by 7½ in. broad for the glass, and oblong spaces 4 in. wide between each inner rail and the rail of the outer frame parallel with and nearest to it. A rebate of the required length is cut in each for the reception of the glass, which is secured at the back by a small beading. The whole framework is glued together, and if the tenons fit, as they should, so tightly into their respective mortises as to necessitate some little force being used to drive them home, nothing more is necessary. Care should be taken in joining up to keep it square. After this it is painted or otherwise decorated, the glass fixed in its place, and the hooks and plates by which to hang it to the wall screwed on, and it is complete. For purely decorative purposes I added a thin back, covered, where visible from the front, with Japanese gold leather paper, which improved its appearance wonderfully. The mirror might be dispensed with, and the centre space treated in the same manner. To those who intend using a mirror, I would suggest procuring it first, and making their framework, so to speak, to fit the glass; for the simple reason that one of stock size would cost considerably less than one made to order to a given measure.

The dimensions of the umbrella-stand are—length, 2 ft. 4½ in.; breadth, 9½ in.; and height to top of posts, 2 ft. 7½ in. Its construction is as follows: Four posts 1¼ in. square and 2 ft. 7½ in. long, whose edges are stop-chamfered, are connected by eight rails, which are mortised ¾ in. into them. These rails are ½ in. thick; the upper ones are 1½ in. wide, and are mortised into the posts 1½ in. below the tops of the latter; the lower ones are 3 in. wide, and their lower edges, which are rebated to take a thin bottom, are 1 in. above the floor. The front and back rails, top and bottom, are slightly notched at a distance of 7 in. from the posts, for the reception of the sides of the cupboard, which are let into them. These sides are of ½ in. stuff; they fall ¼ in. short of the under edges of the lower rails, to allow for the thickness of the bottom, and project the same distance above the top rails, in order to be let into the top of the cupboard, which is grooved to receive them. They are rebated to take a thin back, and grooved for the shelves, which are slid into their places from behind after the sides are fixed and before the back is screwed on. Their front edges are lined up to 1¼ in.

The various parts are glued together, with the exception of the bottom and the back of the cupboard, which are screwed on, the top being blocked inside for additional security.

Two large flower-pot saucers serve as receptacles for the drippings of wet umbrellas, though, doubtless, zinc trays would look better, and a small curtain answers the purpose of a cupboard door in screening from sight clothes-brushes, slippers, etc. Doubtless these little articles are more or less makeshifts; but they are extremely useful ones; and as their construction is so simple as to be within the ability of all who can use a saw, plane, and mortise-chisel with a very moderate degree of skill, and they can be made for about as many pence as a good hall-stand would cost shillings, they are by no means to be despised.

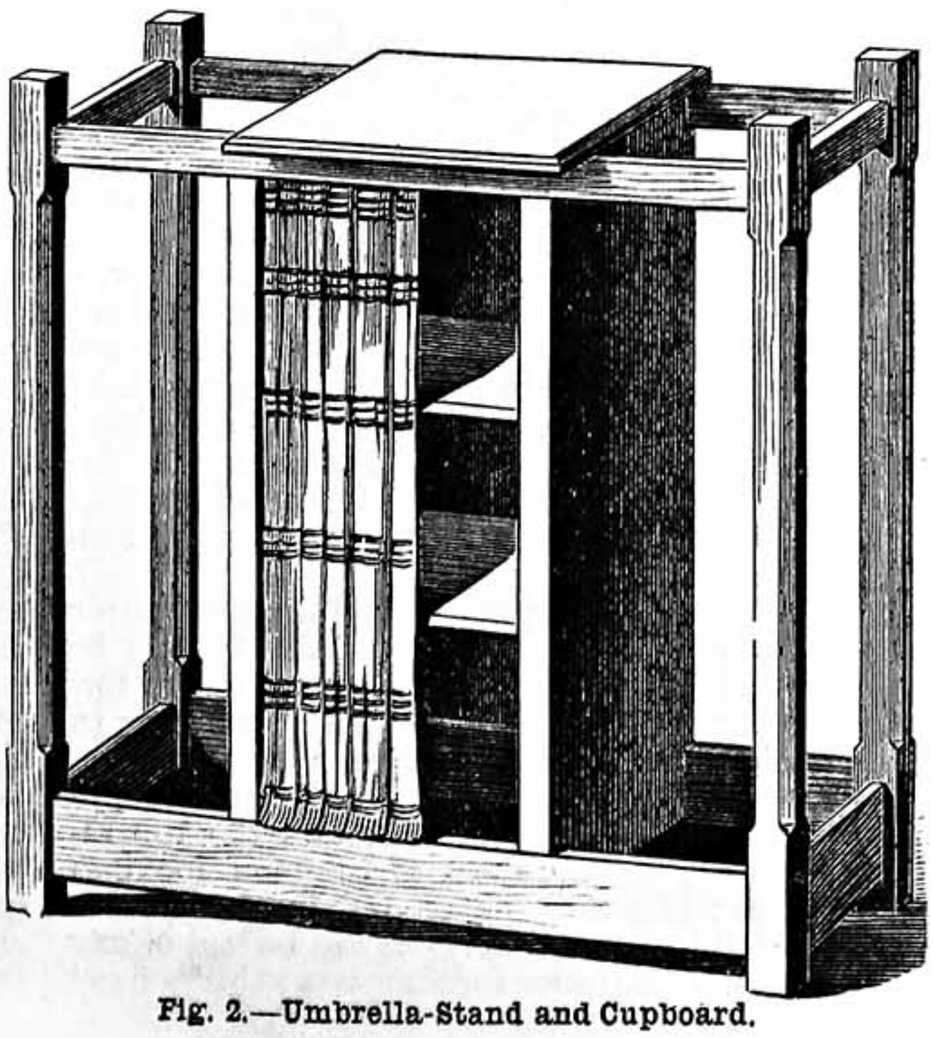


Fig. 2.—Umbrella-Stand and Cupboard.

SOME WORDS TO WOULD-BE PATENTEES.

BY "AN INVENTOR."

WHERE TO FIND COPIES OF PATENTS—INDICES TO PATENTS—FORMS A AND A 2—POSTAGE—RULES FOR DRAWINGS—APPARATUS FOR COPYING DRAWINGS—COPYING MANUSCRIPT—CORRESPONDENCE WITH COMPTROLLER—REGISTRATION OF PATENT AGENTS—PROVISIONAL PROTECTION—WHEN ACTUAL PROTECTION COMMENCES—PROTECTION IN NEW ZEALAND.

"A CONSULTING ENGINEER" enforces the necessity of instituting "a most *careful* and *analytical* search through all the specifications *relating to the subject*," but omits to say where such search can be made, or how an inventor is to go about making the search; so I will supply the omission. In addition to the library at the Patent Office, full copies of every patent granted from March 11th, 1617, to the present time, with indices; reports of patent

trials, all carefully indexed, so as to enable anyone quickly to discover every question brought up in the Courts for decision; the official weekly journal, also carefully indexed, with abstracts, at the following places, which can be seen or copied by *anyone free of charge*:

Aberdeen, Public Library; Birmingham, Central Free Library; Bolton-le-Moors, Public Library, Exchange Buildings; Bradford (Yorks.), Free Library; Brighton, Free Library; Bristol, Free Library, King Street; Cardiff, Free Library and Museum, from 1871; Carlisle, Public Free Library, Police Office; Cork, Royal Cork Institution, Nelson Place; Derby, Free Library and Museum; Dublin, National Library of Ireland, Kildare Street; Glasgow, Stirling's Library, Millar Street; Halifax, Town Hall; Huddersfield, Corporation Offices; Hull, Mechanics' Institute, George Street; Ipswich, Museum Library, Museum Street; Keighley, Mechanics' Institute, North Street; Kidderminster, Free Library, Public Buildings, Vicar Street; Leeds, Public Library, Infirmary Buildings; Leicester, Free Library, Wellington Street; Liverpool, Free Library, William Brown Street; London, Patents Library, 25, Southampton Buildings, Chancery Lane, W.C.; ditto, British Museum; ditto, Free Library, London Street, Bethnal Green, from 1869; Manchester, Free Library, King Street; Newport (Mon.), Commercial Room, Town Hall; Nottingham, Free Public Libraries; Oldham, Free Library, Union Street; Plymouth, Free Library; Rochdale, Free Library, Town Hall; Salford, Free Library, Peel Park; Sheffield, Free Library, Surrey Street; Stockport, Central Free Library; Swansea, Free Library; Wolverhampton, Free Library.

If a private copy of any patent is desired, the price is marked on it in plain figures, and is sent free, plus the amount of postage (book rate), to any address in the country by the Comptroller of Patents, 25, Southampton Buildings, Chancery Lane, London, W.C. He will also send, post free, the Patents, etc., Act, 1883, for 1s. 9d.; ditto, 1885, 2d.; ditto, 1886, 2d.; ditto, 1888, 2d.; Patent Rules, 1883, 7d.; ditto, 1885, 3d.

The indices to the patents are chiefly of two kinds: viz., a *Name* Index and a *Subject Matter* Index; there are others also. This latter enables us to see at a glance the number of any patent for the year on the subject in hand, and the Patent Specification itself can be referred to at once on the shelves; and who so likely to recognise the same invention in another form as one who has invented or worked it out? Certainly he would be a very clever patent agent who could equal all-round, on every subject, every inventor; but if a visit is paid in the daytime, we shall find youths—merely lads—doing the searching for local patent agents. Everything is so nicely arranged, that as soon as the system is understood, the back patents on the subject can all be quickly examined: this *may* be done before applying for a patent, but I should never advise an inventor to employ a professional patent agent, as, if he is capable of inventing anything, he is quite qualified to "search." Reports of ALL patent cases tried in the Courts are also SUBJECT MATTER indexed, so that easy reference can be made to any subject tested; in fact, carefully reading and studying these reports will give inventors more insight into the requirements of the Patent Laws, and how to understand the various Acts of Parliament, than all the patent agents' circulars and barristers' law books—written for ignorant inventors—put together. When a man can be his own lawyer, he has an advocate that will do his utmost for his clients' interests, and such a one will not always keep an eye on future possible employment. The greatest crime a professional man can do, whether a patent agent or solicitor, is doing things "unprofessionally"—that is, depriving himself and his professional brethren of all chance of making a *future* "picking." This is no advantage to a patentee, therefore he should learn to do things himself, so as to be able to tell if they are done right, even if he does not do them himself.

This article should be read as a supplement to that of "C. C. C." in WORK, Vol. I., page 545, in which all statements may be considered as being fairly correct, with the exception of the following:—Form A is the Application Form when applying for a patent by an original inventor or a British invention; Form A 1 is used when the invention is an imported foreign one, taken out in the name of a resident in this country; Form A 2 is for use when a foreign inventor applies in his own name, but wants it dating back to correspond with the date of his home foreign patent.

There is no need to pay postage on any package sent to Patent Office, beyond the stamps on the forms; just write on, "O. H. M. S.," this is quite enough; so that if the inventor does the work himself, the cost out of pocket to get his patent is just £4—no less or more.

The rules for the drawings are not on the form for the "Complete" Specification; the requirements are, that it be *white drawing* paper—Windsor and Newton's keep it, and it can be had from their customers; most drawing papers have a "creamy" colour, which is objected to; the "white" is often difficult to get. The size to cut it is 13 in. by 8 in., or 13 in. by 16 in., and must have a margin drawn half an inch from the edge all round, within which all the writing and drawing is to be done. If the drawings are done to scale, the scale must also be shown on every sheet; on the top right-hand corner of each sheet, must be marked the number of sheets of drawings, and what number that sheet is; on the left-hand top corner is to be marked the number and year, and whose Specification it is; on the bottom right-hand corner the sheet has to be signed by the applicant or his agent, and every drawing must be in duplicate, one of which must be marked a "True Copy."

Now, to most people it is no joke to make a drawing on thick drawing paper in Indian ink, and then make a *true copy* of it, exact in every respect. It was a difficulty I was much puzzled over at first; but, however, I hit on a plan at once simple and efficient, which I think will be found of use to many more people besides what are likely to take out patents; for instance, I showed the plan to a lithographic printer, and he was delighted with it as a means of taking tracings on "transfer-paper," to lay down on the stone.

The whole apparatus is the most simple and inexpensive, and the materials may be found in every house, and fixed up in a few minutes—in fact, I had my first working in half an hour. Fig. 1 shows at A a common box—it does not matter whether it is square or oblong—with one side and the top removed; C is a sheet of common looking-glass; if one is not found in the house—which is very unlikely—it can be had of any small ware dealer for sixpence: this is fixed at an angle of 45 degrees, which is to reflect the light *upwards* from the gas or lamp, Fig. 2. No tools are required to do this correctly: just light the gas or lamp, and look *downwards* until you see the light fairly in the centre of the glass, then drive two tacks in the box, at the foot of the looking-glass, to keep it from slipping out of place; the looking-glass can thus be fixed into the box, and taken out any time. A plain level sheet of transparent glass is now fixed on the top to trace on, when the box is complete. Fig. 2 shows a gas burner, but I prefer to use a petroleum lamp, with another looking-glass on one side to reflect more light into the box, and an opaque shade fixed on the chimney to keep the light out of the eyes while working.

Fig. 3 is a spring clip, to clip the two sheets together while being copied; two of them will be required for opposite diagonal corners: these are made out of a piece of clock spring or other similar sheet steel. I make them by holding a piece in the gas till hot, and then bending the two ends close together. I first of all make a drawing on thin white paper, on a drawing-board, which is finished in ink as black as possible; this will perhaps have numerous compass holes in it. When I have got it right I fix it under a sheet of drawing paper by means of the clips, Fig. 3; and now lay it on the sheet of glass B, on top of A, when the reflected light from lamp, or gas, will show clear through, making the drawing quite distinct, which I can quickly trace in Indian ink; the two sheets being clipped together enables me to turn them about anyhow so as to fix it just right for drawing every line. I can thus make any number of exact copies on the thickest drawing paper.

I am not sure that this plan of making exact copies is new or not. I have never seen it described, and it is, as far as I am concerned, my own invention: which, though it may be largely used, is really one of those things that are not worth patenting, simply because everyone who wanted to use one would make his own, and there could be no means of detecting him, or getting in any royalties.

The Tracing Box will meet a great want, both amongst amateur and professional patent agents, as very few can copy their own drawings satisfactorily.

There is no limit to the number of sheets, either in Drawings or Specifications, that may be sent in, and here again I may give another useful wrinkle. All documents require to be in duplicate, and fifty or more sheets of foolscap manuscript is no joke to copy. I work it thus: the rules say "written or printed," so I write the Specification in strong copying ink; I then get some strong thin sheets of unruled white foolscap paper, and place a wet cotton cloth between two sheets until quite damp, and then copy on these in the press in the ordinary way, taking *two* copies, one to keep and one for the Patent Office, to go with the original; the ink strikes through, and shows well on the other side. These copied duplicate sheets are quite within the rules, and are really preferred at the Patent Office, as only one set need be examined.

Having said thus much, I will now tell the public what treatment they may expect from the officials at the Patent Office. This is it: if you want any information regarding taking out a patent, write a courteous and respectful letter to the Comptroller—no need to pay postage—and he will send you a courteous reply back, giving, if possible, the information you ask for *all for nothing*—in

fact, I need to say no more than "Write for particulars to the Comptroller." Patent Agents think he interferes with their business by doing this, though he is strictly doing his duty to the public, as one of their servants. I will try to make it clear why this is so. The Patent Laws and the Patent Office exist for the benefit of the *public*, not for Inventors, nor yet for Patent Agents. Every useful invention is a public gain, and the duty of the Comptroller is to collect, and make public, every invention he possibly can, so that the public may have the benefit of it; the offer of a patent for a term of years, on behalf of the Crown, is an inducement he is allowed by Parliament to offer to all inventors who disclose their inventions to him: he naturally wishes to induce as many inventors as possible to come forward, and he certainly would not be doing this by giving them *worthless* patents; he therefore, to inspire trust and confidence amongst inventors, carefully examines all Specifications sent in, and if he notes any fault or error, he sends it back to be rectified. I have seen Specifications sent back because a comma had been omitted. It certainly is not his fault, if a Specification is defectively drawn; what he does, and has done, and what I have heard patentees say in the Local Patent Library he has done for them, in the way of help, seems too absurd to relate. The Yankee tale about the railroad agent (station-master) who kept a train waiting until an old hen laid an egg, to oblige a woman who was one short of a dozen to send by it, quite pales before the stories I have heard.

If you go to a Tax Office, you may be treated with scant ceremony, because *you are obliged to go*. But not so at the Patent Office: there the whole British public employs the Comptroller and his staff, to get your invention out of you, for *their* benefit, not yours; so it is his duty to use every inducement the law allows him to get it. Professional Patent Agents may want to stand between the inventor and the Patent Office, but there is very little need for their services, and inventors should look out for themselves, or their rights will be seriously curtailed. Patent Agents got the thin end of the wedge in by the Act of 1888; they will not be long before they give another blow to the freedom of inventors. So far, there is nothing to prevent "C. C. C." or anyone else acting as an "unauthorised" Patent Agent, or offering his *services* or assistance to inventors by advertisement, as long as he does not call himself "Patent Agent," or sign the documents as "Agent." As long as everything is done in the *name of the Inventor*, and all the signing is done *by him*, it does not matter who draws the documents up. I see Patent Agents are advertising themselves as "Registered," implying that they are "duly qualified." The Act of 1888 says: no person shall represent himself as a "Patent Agent" unless he is registered; but on the other hand, any person who has acted as a Patent Agent previous to the passing of the Act *is entitled to be registered*, no matter how little his knowledge of Patent matters may be. In future, the principal condition on which Patent Agents may be registered, is that they have served for a certain time to one of these possibly incompetent registered agents; thus the public get no guarantee. In fact, the Act of 1888 is simply to keep down the supply of Patent Agents, because many were doing work, under trade-statement prices. I have no sympathy with anyone who wishes to dictate or regulate the price of anything. I hold that the Law of Supply and Demand should do this; nor do I hold that anyone has a right to dictate to another man how little or how much he shall demand for his skill or labour. If a man wants a good price for his work, let him excel everyone else in its *quality*, and sooner or later he will get all he asks, no matter how others may be cutting under him. Many Patent Agents quote "so much" for taking out a patent, which they do on the principle of "averages"—that is, taking one with another. If a man chooses to do his business in this manner, he has a perfect right to do so, and I am not going to blame him, nor hint that such a person's work is not to be depended on; on the contrary, some of the Patent Agents who do business in this way are the most competent, trustworthy, and reliable in the profession.

In No. 46, page 731, "C. C. C." does not draw quite safe deductions. I agree with him that "Provisional Protection" makes an inventor "as safe as if the patent had actually been granted"; but it gives him no protection against anyone who infringes *previous to the date of the acceptance of the Complete Specification*. If the infringer is a sharp, unscrupulous person, he might assert that he had been publicly making and selling the things *previous* to the date of the patent; and as such statement is not on oath, no charge of perjury can be made; no doubt he will have confederates to whom he will kindly refer you, who will show you invoices dated months previously, so a timid inventor may be frightened out of his rights; such a person, by lodging the proper form at the Patent Office (price 5s.), will be duly informed of every step taken; so that as soon as the Complete Specification is accepted, he can either back out scot free, or file opposition; if he does this, he may get a perpetual free licence to "square" him. This is no imaginary matter. In one patent I took out, I simply said that I had solved a problem that had been before the world ten years for anyone to solve. The matter was noised all through the trade; everyone was soon guessing, and numberless were the tricks resorted to, to learn how the thing was done; but kind friends told me to be cautious, because no matter what it was, it was decided to declare that it was "old."

One party professed to be my friend, and begged me to tell, just himself, as a particular favour, and he would be strictly "masonic" over it. I would not until after the date of acceptance of Complete Specification, though I made no secret of what the thing was like, and invited anyone to guess; one editor said if I could do that, it would be a novelty indeed. As soon as it was known what it was, up they all jumped to cry that it was *old*, my particular "masonic" friend heading the lot; and though they were twelve months after the date of my patent, and though I hold letters, in which it is declared such a thing is absolutely impossible, and hinting that I was surely taking them in, they actually presented me with a very formidable-looking list of names of people, who they said had made and used such, previous to the date of my patent. What inventors should do, is to always file a Provisional Specification, and delay filing the Complete one as long as possible, keeping their invention as secret as possible in the meantime; by this means, they get ten or twelve months' start of all such gentlemen.

"Patentee," page 574, No. 36, must read

A.D., 1891. No. 0000. *8 Sheets.*
Smith's Specification. *No. 1 Sheet.*

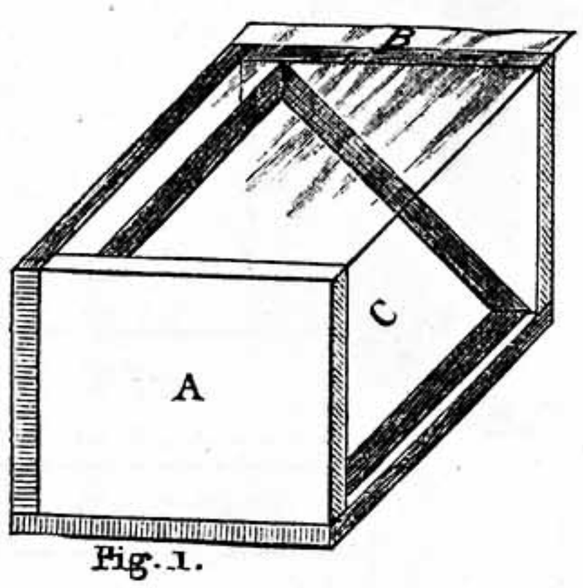


Fig. 1.

Fig. 3.

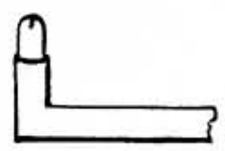


Fig. 2.

Fig. 1.—Box for making or tracing exact Copies of Drawings, etc., on Thick Drawing Paper—A, Any Common Box with the Top and one Side removed; C, a Common Looking-Glass fixed at an angle of 45 deg. inside it: a Plain Sheet of Glass fits on Top at B. Fig. 2 is the Source of Light, which may be Gas or Lamp, and reflects from C upwards. Fig. 3.—A Bent Steel Clip.

True Copy.

John Smith,
Applicant.

Example of Sheet of Drawings for Patent Office.

work, under trade-statement prices. I have no sympathy with anyone who wishes to dictate or regulate the price of anything. I hold that the Law of Supply and Demand should do this; nor do I hold that anyone has a right to dictate to another man how little or how much he shall demand for his skill or labour. If a man wants a good price for his work, let him excel everyone else in its *quality*, and sooner or later he will get all he asks, no matter how others may be cutting under him. Many Patent Agents quote "so much" for taking out a patent, which they do on the principle of "averages"—that is, taking one with another. If a man chooses to do his business in this manner, he has a perfect right to

Acts of Parliament differently if he is to teach Law. Patent Specifications are always interpreted according to what they *mean*; whilst Acts of Parliament are interpreted by what they *say*. Let him read section 14 again: he will see that it simply says that an invention for which a patent has been applied for, may be used and published, without prejudice to the *grant of a patent*; section 15 invests him with all the rights and privileges of a patentee from the date of the acceptance of the *Complete* Specification, though he does not get his patent for ten weeks after. If Parliament had intended a patentee to have the privileges of a patentee from the date of his patent, or the date of Provisional Specification, they would have said so; but instead, the Act says clearly and distinctly "the date of the acceptance of the *Complete* Specification." *Therefore it is, or should be, clearly evident to anyone of ordinary comprehension* —unless it is "Patentee"—that no action can be brought on anything done in infringement previous to the date of the acceptance of the Complete Specification, simply because Parliament says a patentee shall not go beyond that date in claiming anything in an action for infringement; while section 13 says, "Every patent shall be dated and sealed as of the day of the application, provided that no proceedings shall be taken in respect of an infringement committed before the publication of the Complete Specification."

On the 1st of January, 1890, a new Act came in force in New Zealand, entitled a "Patents, Designs, and Trade Marks Act"; it is almost word for word, the British Act of 1883, the forms being obtainable at any money-order office in the colony, and transmissible by post. The principal differences are as follows: 10s. is payable in filing application, which may be accompanied with a Provisional or Complete Specification; 10s. on filing a Complete Specification in nine months, and £2 on sealing the patent: total fees, £3. There is a further payment of £5 before the fourth year, and £10 the seventh year; but there is a new departure, that I think all inventors will be interested in, *viz.*, that British patentees have twelve months from the date of their British patents to apply in New Zealand for a patent, and when they do apply, the patent takes the same date as the British one, so that all British patentees get twelve months' Provisional protection in the colony.

There are quite a number of matters I have left untouched; but should any difficulty arise, they can be answered in "Shop." The present paper will, along with "C. C. C.'s" article, act as a good guide, and what is not mentioned will, I think, be readily found in the libraries I have given a list of. Thousands of inventors daily pass them in ignorance of their existence, or that they have a perfect right of access to everything in them *free of any charge whatever*, no matter where they live or come from. It is only right that information on this point should be placed within the knowledge of the readers of WORK, and this I have sought to supply to the best of my power in the foregoing remarks on this subject.

A HANDY MEAT SAFE.

BY "AN AMATEUR CARPENTER."

INTRODUCTION — WOOD — CONSTRUCTION OF PARTS AND PUTTING TOGETHER—CONCLUSION.

Introduction.—Now that the hot weather is coming on—or, at least, summer is approaching—a meat safe will be a very useful article in which to store commodities of daily consumption in the household, and all things that are likely to suffer from the delicate attentions of the inquisitive housefly. It is especially hard in hot weather to keep articles from going bad, and, besides, a safe is a very simple article to make, so that the amateur may not shrink from attempting to construct such a useful thing, as anyone with a slight knowledge of carpentry and a few simple tools can do so.

I will now proceed and give some instructions to help in making one.

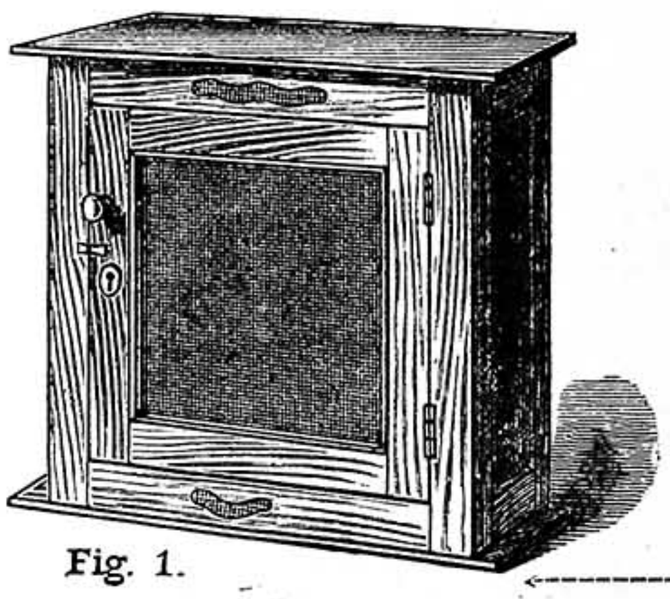


Fig. 1.

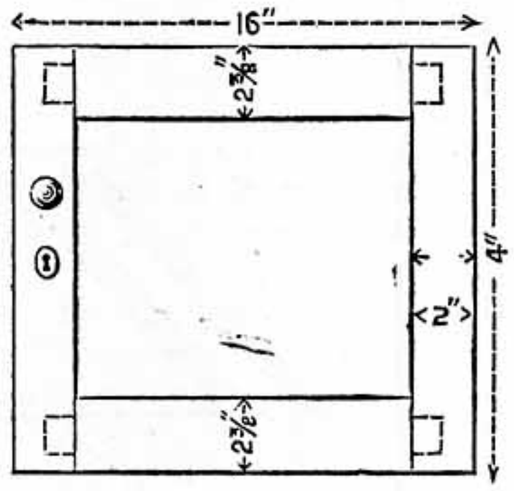


Fig. 2.

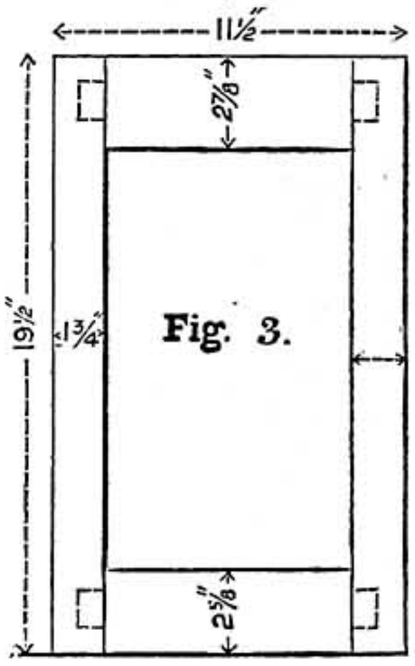


Fig. 3.

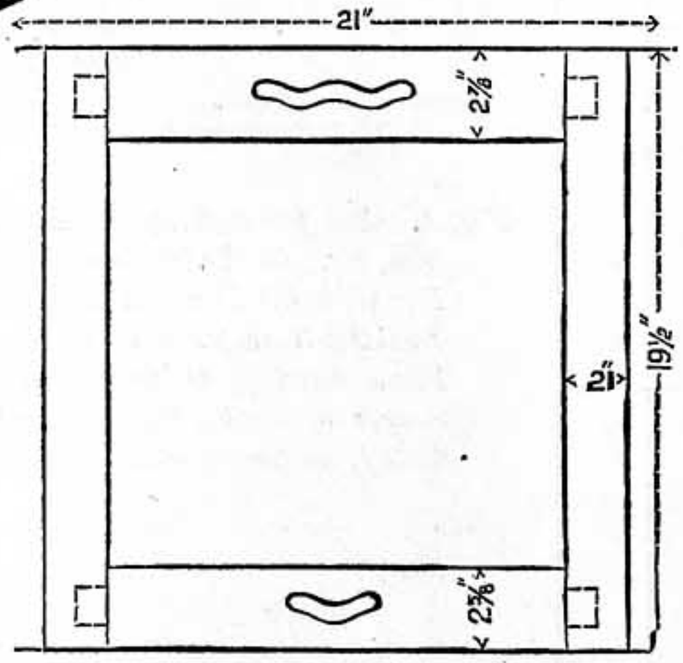


Fig. 4.

Fig. 1.—Safe complete, in perspective. Fig. 2.—Framing of Door. Fig. 3.—Side of Safe. Fig. 4.—Framing of Front in which Door (Fig. 2) is hung.

Wood.—The best wood will be yellow pine, and the sizes that are wanted can be seen by referring to the illustrations. It had better be about ½ in. or ⅝ in. thick.

Construction of Parts.—Fig. 1 shows the safe complete, in perspective. Fig. 2 is a view of the door. About 14 in. high by 16 in. wide would be a good size for the outside measurements. The width of the wood for the top and bottom pieces had better be about $2\frac{3}{8}$ in., and the uprights about 2 in. across. Fig. 3 shows the side piece, two of which must be made. The sizes and length of the wood are shown in the illustrations. In this figure, and also in Figs. 2 and 4, the joints had better be mortised and tenoned if the reader cares to. Fig. 4 shows the arrangement minus the door. The two holes cut in the top and bottom are for the zinc to be nailed at the back of each. Of course, it is understood that zinc will be wanted for the door and side pieces. In Fig. 3, it will be noticed that there is another line on one side of one of the uprights. This is to show how the front is joined, and that line represents the thickness of the wood of Fig. 4, and the way of putting together. For the top and bottom and back of the safe, some small planks of wood must be nailed on to the uprights. The interior had better be fitted with a shelf and a small hook, attached to the top of the safe, for hanging meat on. The shelf, for convenience, may be made so as to be removed in case it is wanted, as a large joint of meat would not be able to hang unless the shelf was very low, which would not do, as nothing could be placed underneath it.

Conclusion.—In concluding, I may say that I think the reader would find it very easy to put the parts together, and also to make them. The boards at the top and bottom had better be about ½ in. each way wider than the uprights; and if it be exposed to the damp or rain, some thick felt (which can be got at most ironmongers' at about 6d. per yard) had better be nailed on the top. The other fittings, viz., a pair of hinges, a lock and key, and a small handle, can be obtained at almost any local ironmonger's, as can also the zinc which will be wanted for the door and sides. Any inquiries on points not made quite clear I shall be happy to answer through the medium of "Shop."

PHOTOGRAPHIC TENTS.

BY AN OLD HAND.

TRAVELLING TENT—FOLDING TENT—HOWARD TENT—PLATE CHANGING BOX—LIGHT CHANGING BOX—SACK TENT.

No. 2 is a lighter and more portable form of tent, useful when the smaller sizes of plate have to be developed; but as the room inside is somewhat limited, the face is necessarily much over the developer, and if ammonia is used, is somewhat disagreeable to work in, besides being close and hot. It is, however, a practicable tent enough for occasional use, for merely changing plates and ticketing them is all that is necessary. It consists of two shallow double boxes hinged together, each 24 in. by 16 in., and 2 in. deep. When open, the half that is raised up, and kept in place by a knee and strut on each side, is partitioned out for holding bottles, brushes, etc., with a small ruby glass window in the middle. The lower half is screwed on to a stout tripod, and acts as a receptacle for the frame and cover when packed, and which is not removable, as in No. 1, but carefully attached to the case in the manner shown in the diagram. It is intended that the operator shall stand to work in this tent. He slips the bag at the back over his head, and fastens it round his waist with a buckle and strap, the upper part of his body only being under cover. The fixing bath is arranged as in No. 1, the water supply being contained in an indiarubber bottle hanging outside the tent, and communicating by means of an indiarubber tube with the inside, where it terminates with a pinch tap. The ventilator is similar to No. 1.

No. 3 is somewhat similar in design, but, instead of the double box, consists of two boards arranged in a similar fashion, and fixed in position with elbow struts, with a window in the upright one. The framework

Fig. 5.

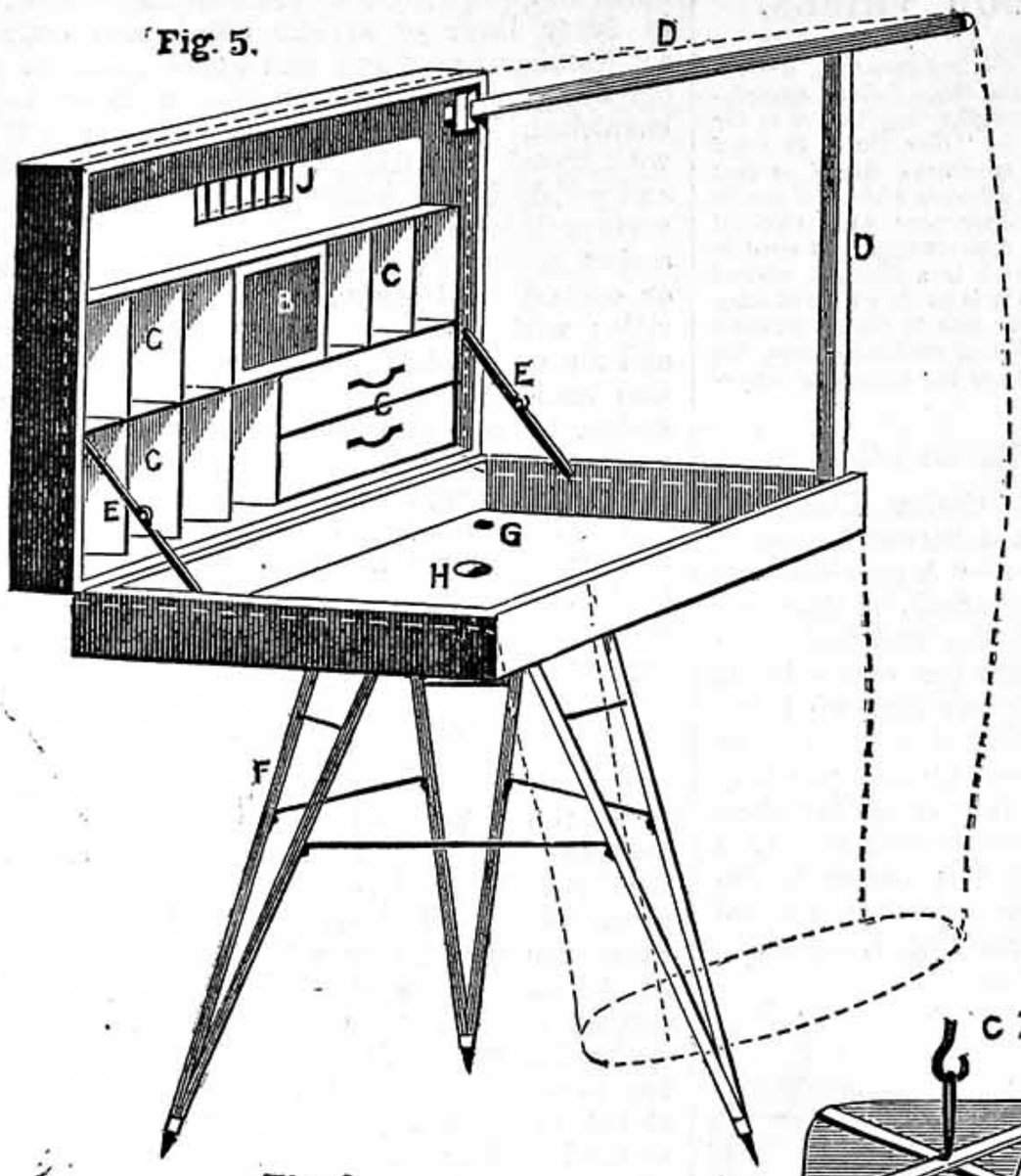


Fig. 7.

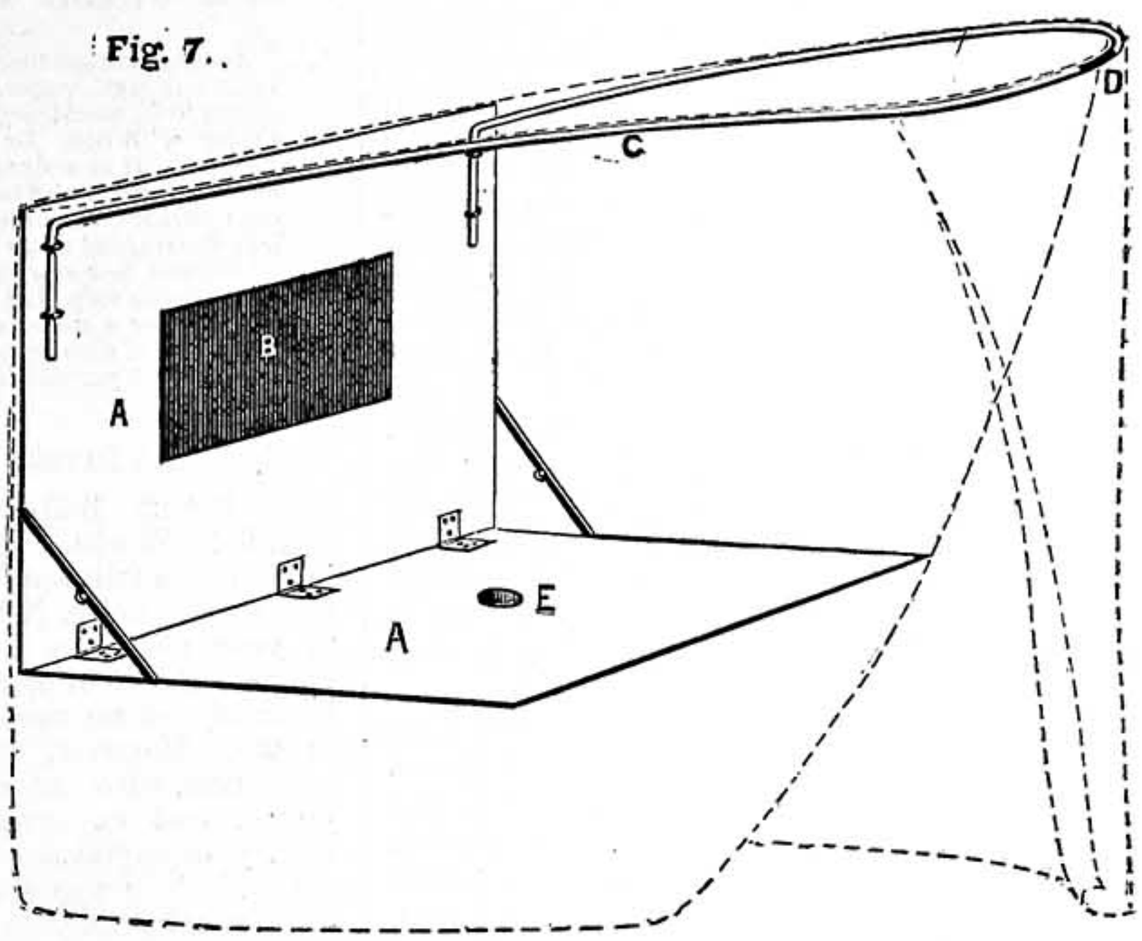
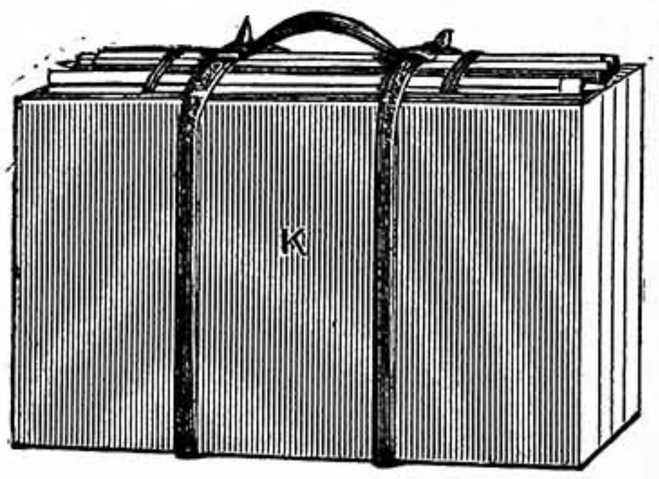


Fig. 6.



C Fig. 12.

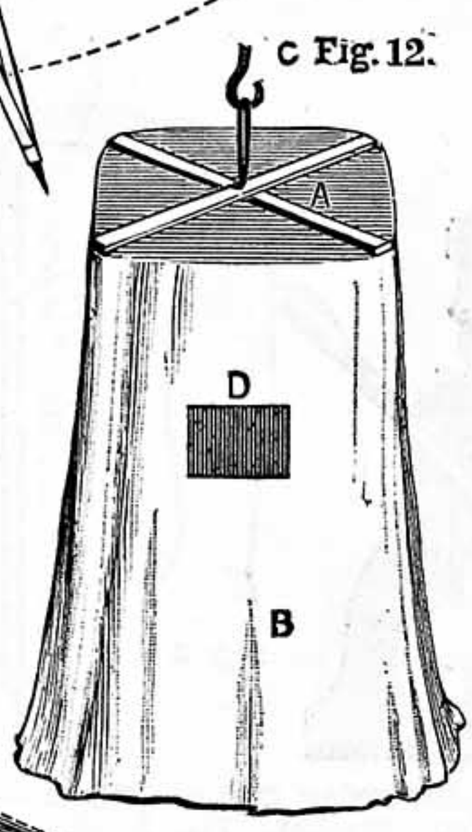


Fig. 8.

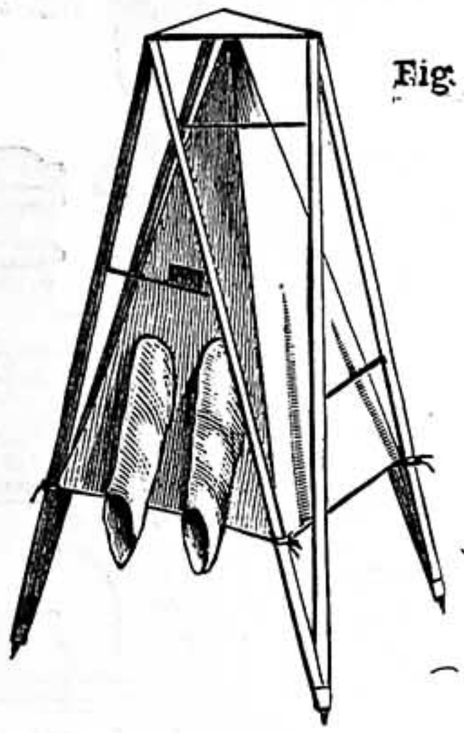
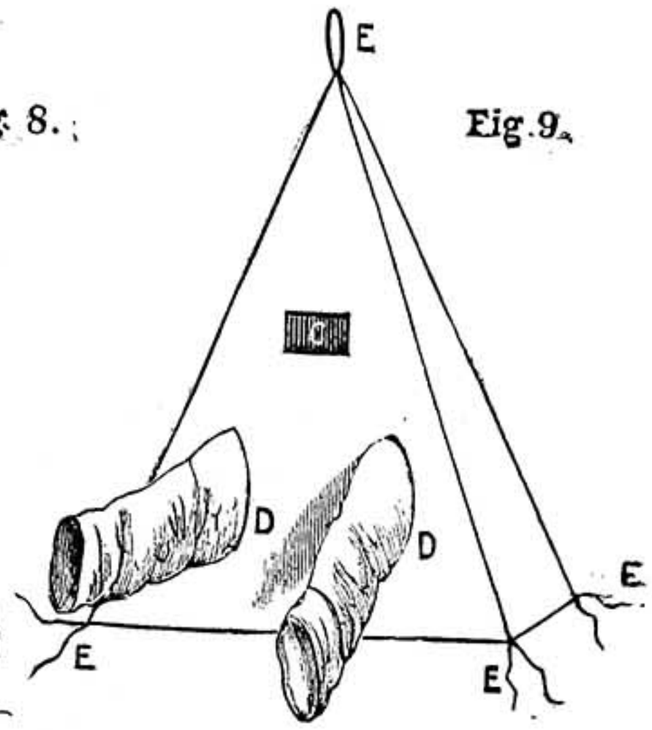


Fig. 9.



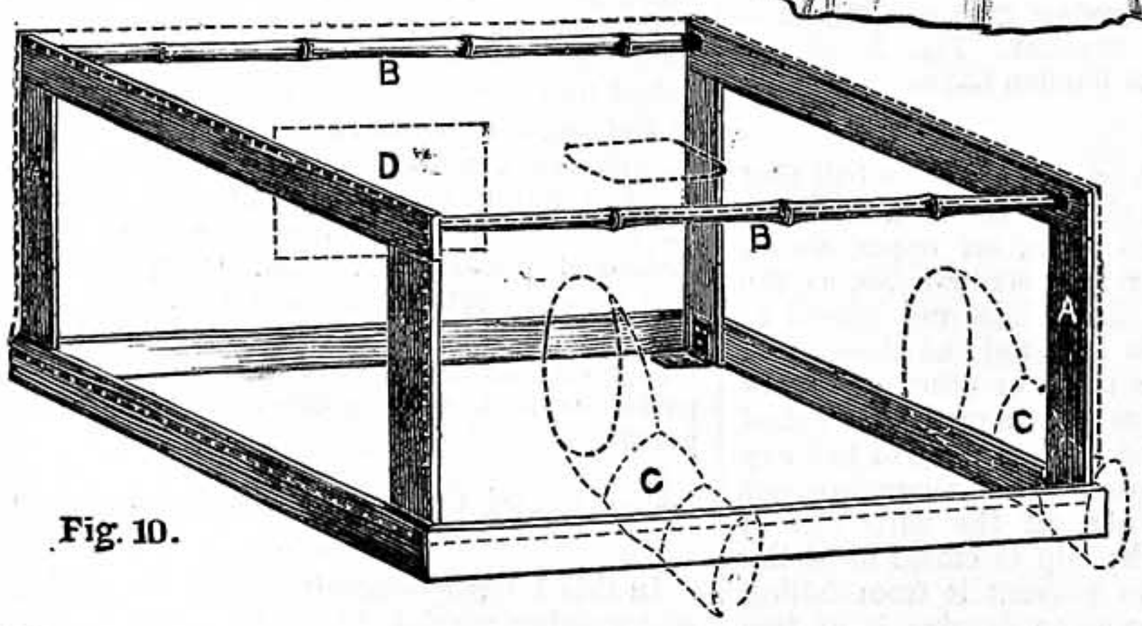


Fig. 10.

B

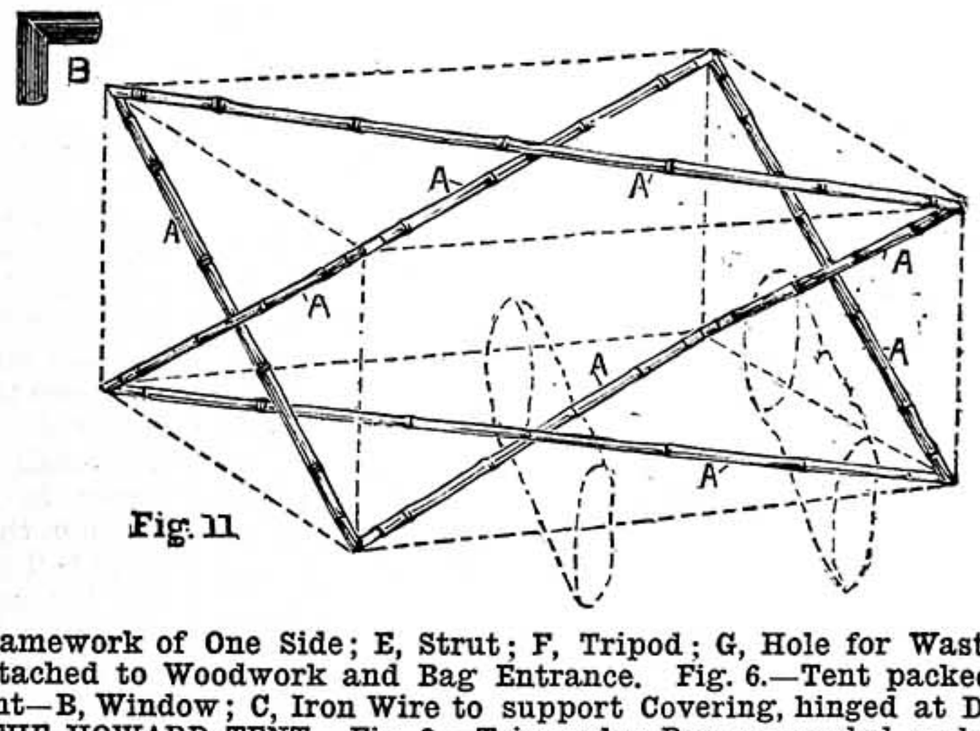


Fig. 11.

TENT No. 2. Fig. 5.—Tent Set up—B, Ruby Window; C, Partitions for Bottles; D, Framework of One Side; E, Strut; F, Tripod; G, Hole for Waste Pipe; H, Bolt to Tripod; J, Ventilator. Dotted Lines show where Covering is attached to Woodwork and Bag Entrance. Fig. 6.—Tent packed, with Tripod at top for transit. TENT No. 3. Fig. 7.—Bottom and Front of Tent—B, Window; C, Iron Wire to support Covering, hinged at D; E, Screw Hole to attach to Tripod. Dotted Lines indicate Cover. TENT No. 4.—THE HOWARD TENT. Fig. 8.—Triangular Bag suspended under Tripod Head. Fig. 9.—Bag detached—C, Ruby Window; D, Sleeves; E, Cords to attach to Tripod Head. TENT No. 5. Fig. 10.—Tent showing Details—A, Frames of quarter-inch Mahogany hinged to each End of Box and folding down when not in Use; B, Bamboo Rods sprung into Hollows in the Frames to stretch out the Covering and support the Ends; C, Sleeves; D, Window. Dotted Lines show where Cover is attached to Tray. To pack, remove Stretchers, and fold down the End Frames and Cover into Tray; put a Strap round to carry it with, and the whole is complete. TENT No. 6. Fig. 11.—A, Bamboo Rods, each Pair pivoted in Centre; B, L-Shaped Ferrule. TENT No. 7.—SACK TENT. Fig. 12.—Tent set up—A, Wood Cross-Pieces; B, Sack; C, Hook in Ceiling; D, Window.

consists of two uprights screwed to the back edge of the lower board, and folding parallel with it when out of use. To fix for use, they are placed upright, and a piece of iron wire jointed in the centre of the back overhead—the opposite ends being bent at right angles—is fitted into eyes attached to the front board. In this case the cover is detachable, and made of one thickness of ruby and one of black twill, similar in make to the cover of No. 1, an opening being cut in the front to admit light, and cross-folded at the back, folding a few inches under the bottom board, and retained in place by a cord. A band with hook and eye fastens round the operator's waist. This tent is only suitable for changing plates and marking them. Of course, it might be used for development in an emergency. The cover is removed, the wire frame doubled, the boards shut together, and the cover wrapped round them and strapped up for carriage.

No. 4 is called a Howard tent, from the name of its designer. It consists of a triangular bag of three thicknesses of material, and is suspended under the tripod

head, the window being made by removing the outer thickness, leaving the yellow and red. The lower corners of the triangle are tied by tapes to the legs of the tripod, which is opened a definite width, and kept so by struts. A small ruby glass window is let in on the one side, also two sleeves, one of them of sufficient width to admit the dark slides and plates, and about 8 in. long, with elastic bands a few inches apart to prevent the light entering when the hands are inserted. The operator looks through the ruby glass, and can easily change his plates. Of course, this tent is unsuitable for the development of gelatine plates, although, by having a folding board for the bottom and a rubber drainage pipe, small plates could be worked in it. The size of the tent is determined by its height from the ground and the width of the legs apart.

No 5 is a tent in which the hands of the operator only are inside; it is thus made. A tray of any desired area, with a frame hinged at each end, which, when not in use, folds on the bottom of the tray. To fix, turn the frames upright, and secure with struts. The cover is attached to the tray, and strained tightly by the upright frames. A window is left on one side, and a ruby glass eye-piece, so to say, on the other; two sleeves, with elastics, allow the manipulation of the plates. In packing, fold down frames and covering, and strap up.

No. 6 is, perhaps, the very lightest contrivance made for changing plates. It consists of eight bamboo rods, each long pair pivoted together in the centre, the shorter ones forming the ends, the longer ones the top and bottom. The end ones are provided with L-ferrules, and the whole covered with an oblong bag, made of a size that will be tightened out when the bamboo rods are opened and fixed. This is provided with two sleeves, as the others. The changing of the plates is entirely done by feel—an easy enough plan after a little practice. A small gummed label fixed on the back of the plates will facilitate matters. The bag may be made of one thickness of black velvet and one of ruby cloth. When packed, the whole makes but a small bundle, and cannot get out of order. Of course, in all these tent-coverings the sewing must be carefully done, and carefully examined afterwards to ascertain its perfectly light-tight condition; inside any wood or metal work blackened with black varnish, to minimise chance reflections.

No. 7 is called a sack tent. It consists of a cylinder of red and black twill, of any suitable diameter, the closed end supported by a cross-piece of wood, two strips pivoted in the centre, with a pin to keep them in place. These are placed at the closed end of the sack, which should be made square, and suspended to a hook in the ceiling of the room. The length of the bag is such that when the operator is inside there will be a few inches space above his head, and two or three inches in folds upon the floor. A window is left by cutting away a few inches of space in the black cover. This, of course, is only intended for changing plates of small size, which may be carried in a satchel hung over the shoulders. Three or four carpet pins will, by pinning the lower edges to the floor, prevent it being accidentally lifted during the exposure of the plates. All tents for photographic operations must be light-tight, with plenty of air-space and elbow-room, easily set up and taken down, and with as few loose pieces as possible.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

34.—The Patent Ball-Bearing Castor.

The Patent Ball-Bearing Castor Company, Highfield Works, Upper Kent Street, Leicester, send me the following letter:—"A gentleman so far away as Leith, N.B., has called our attention to your notice in issue of the 2nd inst. of a castor. He is of opinion that our castor is far superior, and we need hardly say that we think so too. However, we submit a set for your inspection, with one not closed up that you may judge; and we trust that it may so far meet with your approval as to deserve and receive a notice." The appearance of this castor is decidedly attractive, being on a central vertical bearing, as may be seen from Fig. 1, in which

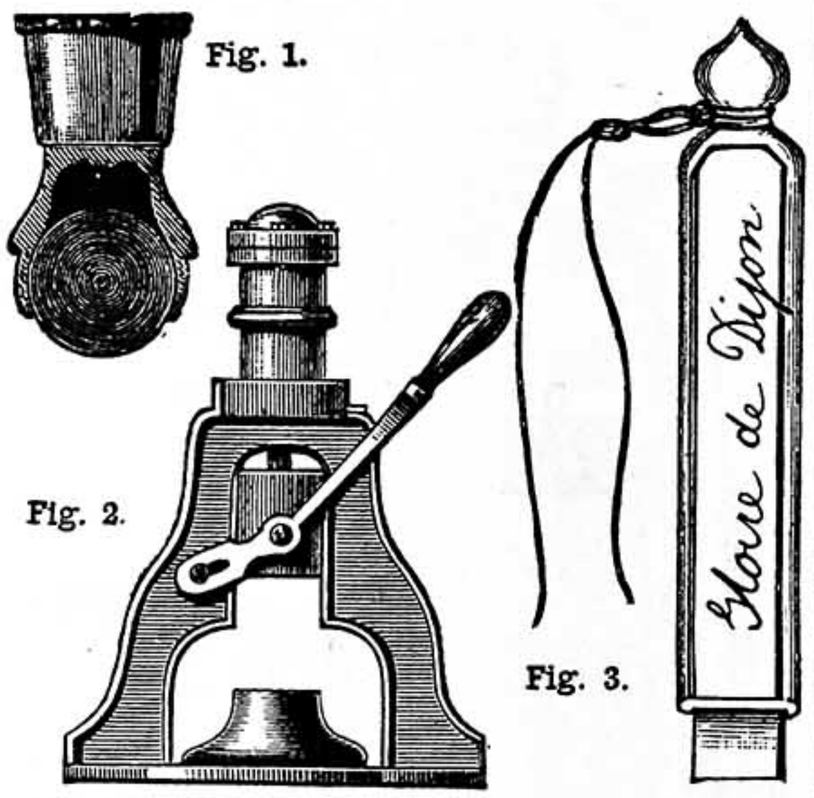


Fig. 1.—Patent Ball-Bearing Castor. Fig. 2.—Doughty's Nut-Cracker. Fig. 3.—Gilles' Crystal Waterproof Garden Label.

the cup that is closed on and over the ball that forms the castor is shown in section. The castor is made in two parts, an upper socket furnished with three or four screw-holes, as the case may be, which is fitted into and braced to the lower cup, which is inverted and closed over the ball on which the table or other article of furniture to which these castors may be attached is moved. Between the ball and top of the cup five small balls are placed, but these are not shown in Fig. 1. When all the balls are in position, the edge of the cup is closed in on the large ball sufficiently to prevent it from falling out, but not so tightly as to deprive it of free revolution in any direction. Now, in theory the castor seems everything that can be desired, and, as far as appearance goes, it is the most attractive form of castor that I have ever seen. I am, however, prevented from trying the effect on a heavy table, as there are only three in the set sent, whereas the table with which I should otherwise have tested them is a quadruped, having four legs. In working them with the hand, under both light and heavy pressure, I find, as I expected, that there is a tendency to jam, and then the large ball is drawn or dragged, without revolution, along the surface over which it is passing, and I am afraid that this tendency would become even more pronounced when the castors are attached to a heavy table or piece of furniture. The Company are right, I think, in describing them as "practically impossible to break or get out of order" (jamming excepted); and in saying that their "use imparts a certain finish and elegance, thus commending themselves to every lover of artistic effect, and entirely superseding the crank and wheel castor of the old type." These castors are made in brass, burnished, lacquered, and highly finished, fitted with metal or vitrified glazed spherical rollers and polished steel bearings, and are supplied in various sizes and patterns—namely, socket plain, socket scalloped; plate, with three screw-holes or central wood screw, or both combined; cabriole; with plate, special pattern, for pianos; and for iron and brass bedsteads, etc. They are also made in suitable forms for heavy window sashes, to facilitate opening or closing, sliding doors or partitions, portable baths, and heavy travelling trunks, etc. They are supplied in eleven sizes, ranging from $\frac{7}{8}$ in. to $2\frac{1}{2}$ in. inside measurement, and the price ranges from 2s. 6d. to 12s. per set of four. Further information will doubtless be accorded by the Company to anyone who may apply for it.

35.—Doughty's Nut-Cracker.

The form and construction of this nut-cracker, from the registered design of Mr. George Doughty, Allnutt Estate, Epping, Essex, will be readily understood from the illustration that is given of it in Fig. 2. As will be noted by those who are familiar with these machines, it is in the shape of a steam hammer. The main casting consists of a base-plate, from which spring the standards on each side, united at the top to support the central tube, whose top is closed over by a plate of the same diameter, secured by four screws, which pass through the plate and the flange encircling the top of the tube. The hammer or crusher is grooved on each side to permit it to work up and down the inner sides of the standards. It is actuated by a lever fastened to the hammer by a pin, about which it works freely, and to the left-hand standard by another pin, which passes through a slot in the fixed end sufficiently long to enable it to move along the pin, when the handle at the upper end is depressed. In the centre of the plate at the base is an "anvil," if I may call it so, attached by a screw, and grooved crosswise at the top to retain any nut that is placed on it in a proper position for cracking. To use the appliance, you place the nut on the anvil, place the *palm* of the right hand on the handle, and apply pressure, not as a blow, but as pressure. On removing the hand from the lever, the hammer moves up to its previous position, being raised by a spring hidden from view in the tube at the top, leaving the nut cracked on the anvil. It will crack nuts of any size, from a Spanish nut to a walnut or a Brazil nut. It is certainly safer and surer in its operation than the old-fashioned nut-cracker. Mr. Doughty tells me that he will send one to any address for 2s. 6d., post free. The iron casting is painted red, or rather vermilion, and it is gilt in the prominent parts, so that it presents an ornamental appearance.

36.—Gilles' Crystal Waterproof Garden Label.

In this I have something good for gardeners, who are often perplexed by the untoward condition to which their labels are reduced, when painted and written on with a pencil, by the combined influences of rain and dirt. In the Crystal Waterproof Garden Label, Mr. W. C. Gilles, 172, Portland Road, South Norwood, London, S.E., has provided a boon for all gardeners, professional and amateur, which, it is to be hoped, will be appreciated by them as it should be. The contrivance is illustrated in Fig. 3. It consists of a flattened tube of glass with a knob at the top, which renders it highly convenient for attaching it to trees, shrubs, plants, or garden sticks, by string in the manner shown in the illustration. At the lower end it is open to receive a slip of Willesden paper, doubled, on which the name of the tree, etc., to which it is attached, is written. The weight of the glass keeps the label in a pendant position, so that no rain can find its way into the inside of the tube to injure the label, and the writing on the paper must then remain

legible for any length of time. For labelling roses it is most desirable, and, I believe, it has been taken into use by numerous firms who make rose culture a speciality. When the durability and legibility of the inscription within are taken into account, the prices for the two sizes in which the labels are made are most reasonable, the smaller size being supplied at 1s. 6d. per dozen. Both sizes are sent post free for 2d. per dozen extra. Visitors to the Crystal Palace, Sydenham, may see them in use in the grounds.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Photo-Lithography.—A. J. A. (*Holborn, E.C.*) writes:—"In reference to PEN AND INK (see WORK, No. 113, page 142) requiring information regarding lithography or zincography, I must presume he is an entire novice, and does not know anything about lithography, or he would surely mention whether he requires information in the artistic or printing department, these being two distinct branches of the same trade. So starting with this idea, and for general information, it may be interesting to note that lithography is a means of bringing before the public in a cheap form copies of notable pictures, which it would be otherwise impossible for them to obtain, besides bringing the public taste to a higher level as regarded from an artistic point of view. I do not speak about those wretched posters one sees on every hoarding, but to those charming pictures by well-known artists which one may see any day decorating the home walls. Take, for example, the Christmas and summer numbers to nearly every paper, which are all now beautifully illustrated by means of this interesting art. Then, again, our Christmas cards, which I do not believe nine people out of ten give a thought to *how* is it done, but which I think one and all agree in saying 'How pretty!' But to turn to the practical part of the business. Supposing PEN AND INK wishes to become a lithographic printer, he would serve an apprenticeship for five or seven years, paying a premium which varies in different firms, when he would learn everything appertaining to the lithographic printer, except drawing on the stone. But should he wish to become a lithographic draughtsman or artist, he would still have to serve his apprenticeship, though in another department. Should he have sufficient energy and patience to study at home, I trust the few hints given in Nos. 106, 109, and 112 of WORK, with those to follow on this subject, will be of some slight assistance in enabling the novice to overcome the difficulties of beginning a new study. With respect to zincography, the only difference between that and lithography is that the latter is drawing on stone, and in the former one draws upon zinc plates, of which there are two kinds—the grey toned ones with which we are all familiar, and lately Messrs. Vincent, Brooks, Day & Sons have introduced into the trade a zinc plate with a litho coating, which certainly makes them more pleasant to work upon, being so much nearer stone colour; but in both lithography and zincography the mode of proceeding is precisely similar, regarding it from the artist's point of view. But if PEN AND INK will ask definitely what it is he requires to know, I shall be pleased, with the Editor's approval, to answer any questions, as I am afraid I have already encroached too much on his valuable space."

"Work" Exhibition Testimonial.—F. W. T. (*Heathfield*) writes:—"I beg here to enclose my sincere thanks for the splendid Book Prize and Certificate, which have arrived quite safely. I am sorry I could not attend the Distribution of Prizes, as I should very much have liked to have been at the close of what has been, not only a great interest to me, but has evidently established me in the confidence of the public, which nothing else in my position could have done. I have here to express my gratitude to Messrs. Cassell & Co., and our worthy Editor of WORK, who first established in me the great object of bringing the mind into more studies than one. I therefore hope that such a valuable volume as WORK may still double its present extensive circulation, and be of as much service to others as it has been to me."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Optical Lantern Condensers and Objectives.—F. J. D. (*Stoke Newington*) has constructed a magic lantern, and fitted the same with a single condenser and objective, but is desirous of re-fitting it with better lenses, as the result is by no means satisfactory. The indistinctness of the single condenser is caused by the loss of light attendant upon the necessarily long focus of the lens. For example, a 4 in. condenser of, say, 6 in. focus will receive only about a fourth of the light it would if it were half this focus; but, on the other hand, shortening the focus of the lens would mean a considerable increase in its thickness, and consequently a greater liability to fracture, owing to the necessity of placing it nearer to the source of light; hence the advantage of using a compound condenser, in which a couple of lenses of, say, 6 in. focal length can be placed together, thus reducing the focus to 3 in., without any additional increase in the thickness of the glass. For the large flame of an oil lamp a couple of 4 in. plano-convex lenses of 6 in. equal focus mounted loosely in a brass cell, with the crowns almost touching (about $\frac{1}{8}$ in. apart), will give a lens of 3 in. focus, which will answer admirably for this class of work, but for limelight use, a meniscus or plano-convex back, and a bi-convex front of about 3 in. combined focus, will give much better results. With this combination some makers erroneously mount the lenses in such a manner that the meniscus side comes next to the picture, instead of which it should face the light in the lantern. The lenses should always be fitted loosely in the cells, in such a manner as to be capable of being readily revolved by means of the fingers; otherwise, the lenses (and especially the back one) may be apt to expand and crack upon the lantern being lighted up. One or two holes drilled in the brass cell will permit the escape of any moisture which might otherwise condense on the lenses. Compound condensers of 4 in. in diameter, and about $2\frac{1}{2}$ in. by 3 in. focus, are quite sufficient to cover the ordinary standard lantern slide, and this diameter should never be exceeded, except in the case of a condenser for a photographic enlarging apparatus, as a lens of larger diameter than the area of the plate to be covered means a corresponding loss of light. I had omitted to state that the lenses should be made of the best white flint glass, in order to get the best results, although a commoner variety is much in vogue by reason of its cheapness. Turning now to the objective, what you require is a short focus lens, which may consist of a couple of $1\frac{3}{4}$ in. lenses (a plano-convex and a meniscus) mounted close together, with the convex surfaces next to the source of light, and a stop in front of the meniscus (as shown in Fig. 1); this combination giving a lens of sufficiently short focus to allow of the lantern being placed at a distance from the screen about equal to the diameter of the latter. Such lenses, by reason of their necessarily short focus, will, however, give a slightly barrel-shaped distortion to square objects. A short focus photographic portrait lens will give a picture slightly fuzzy at the edges, which may be remedied by the use of a stop; but for lantern work this is inadmissible, as it means a considerable diminution in the light thrown upon the screen. The best method of overcoming this difficulty when space necessitates the use of a short focus objective is to employ one fitted with back lenses of large diameter. Short focus objectives are not, however, good to use at any time, as they disperse the light at an angle which interferes with the definition. Some good French portrait combinations—notably those made by Darlot—have large size back lenses and tolerably short focus, which render them eminently suitable for working in a confined situation. Although exhibitors are generally advised to employ an ordinary French quarter-plate combination for the objective of a lantern, they would find a considerable gain in the brilliancy of the picture by the use of lenses of larger diameter than the above, which seldom exceed a diameter of about $1\frac{1}{2}$ in., whereas an old-fashioned carte portrait lens of about 2 in. in diameter will pick up the rays of light much better, and give a more brilliantly illuminated disc. Fig. 2 is a section of the ordinary form of portrait combination, showing the disposition of the lenses. A serviceable objective can be constructed by an amateur by simply mounting together in a metal tube a couple of 2 in. plano-convex lenses of 14 in. focus, placing the crowns of the lenses close together, in a similar manner to a condenser. Longer focus lenses of this description should not be used. A still better objective can be made by making a couple of achromatic lenses, each of which is formed of a bi-convex lens of crown glass cemented by means of Canada balsam into a plano-concave lens of flint glass—the two lenses thus formed being afterwards mounted in a tube tolerably close together: plane sides of the lenses towards the screen. For objectives of, say, 6 in. focus, 2 in. lenses are best to use; and for 7 in., 8 in., or more, they may with advantage be $2\frac{1}{4}$ in. or $2\frac{3}{4}$ in. in diameter. Amateurs should bear in mind that good second-hand lenses can generally be purchased for considerably less than a novice could possibly hope to put one together for. As an example, Mr. Tyler, 48, Waterloo Road, S.E., a short time since offered some 4 in. condensers, the brass-work of which had got soiled, at 8s. each. Mr. Hughes, 82, Mortimer Road, Kingsland, publishes a second-hand list; so does Mr. Tyler; also Prof. Caplatzi, 1A, Chenies Street, Tottenham Court Road. A good selection of second-hand objectives, condensers, and miscellaneous lantern fittings can always be obtained from one or other of the above-named stores.—C. A. P.

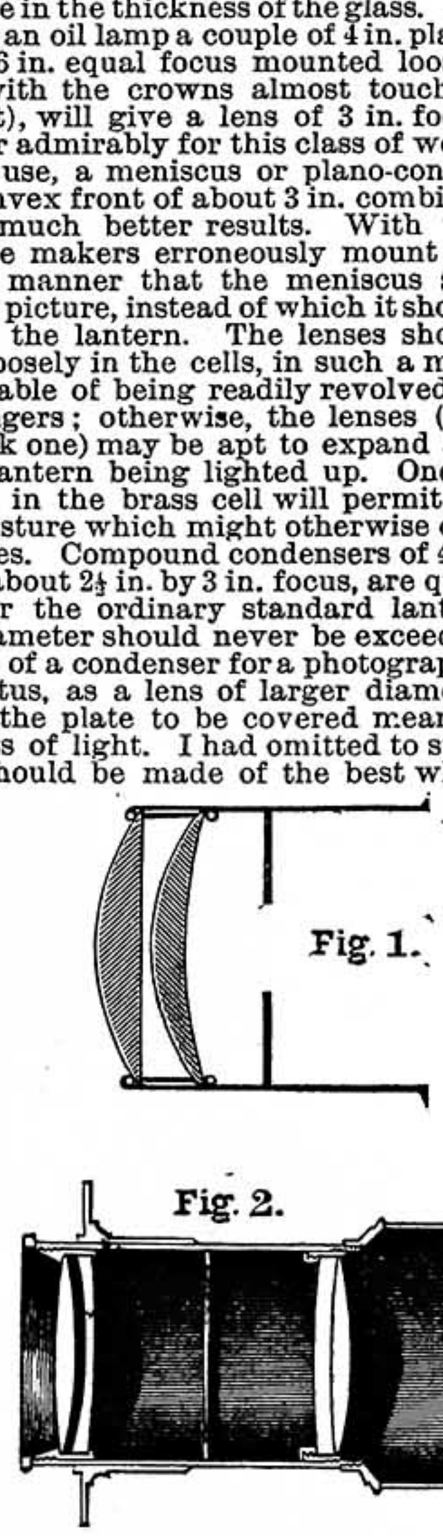


Fig. 1.

Fig. 2.

Fig. 1.—Simple Form of Lantern Objective. Fig. 2.—Section of Achromatic Portrait Lens.

Moderator Lamp Key.—J. L. (*Somerton*).—Glad to find that my description of the moderator lamp, and how to clean and put it in order, was of service to others besides the original querist on the subject. As to whether or no it is worth your while to have a key fitted to it in place of the one missing, that depends upon whether you mind paying the extra cost for oil that using it will entail, for I must tell you candidly that they are expensive lamps to burn. If you have an old-established ironmonger in your town, he will be almost certain to have some of these lamp fittings in stock, either new or taken off old worn-out lamps.—R. A.

"Fur" in Kettle.—M. J. J. (*Aston*).—To clean the corrosion, or "fur," out of a copper kettle, dry it out thoroughly till it ceases to give out any steam; make it as hot as you can, and rap it sharply all over with a small mallet; let the blows be about equal in force, and well distributed over the kettle, so as not to bruise it more than you can help; the fur will then drop off the sides with the concussion. To clean the spout out, I always melt it out, heat it, treat it in the same way, and re-solder it in.—R. A.

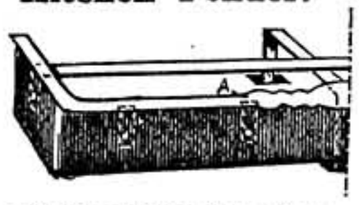
E Puzzle.—PUZZLED.—Your question is unsuited for WORK.

Setting Quadrant of Slide-Rest for Turning Tapers.—H. L. D. (*Strood*).—Suppose you have to turn the plug of a cock, and desire that it shall have a taper of 5 to 1, or that the diameter shall increase 1 in. for every 5 in. of length. You can proceed graphically thus: Take the diameter of your quadrant with callipers, and draw on paper a circle exactly the same size; from the centre of the circle draw a radius, and produce it beyond the circumference; draw a short line across the produced radius, at right-angles to it, and cutting it at a point exactly 5 in. from the centre; now measure from the point of intersection $\frac{1}{2}$ in. up the short line, and join this point with the centre of the circle by a straight line which cuts the circle at a point about $\frac{1}{4}$ in. above the first intersection; measure this distance very accurately with dividers, and it will give you the distance you must turn your quadrant from the zero mark to produce a taper of 1 in 5. Another way is by using a table of tangents. Suppose you wish to turn a taper of 1 in. per foot, or 1 in 12. Now, this is $\frac{1}{2}$ in. in 12, measuring on each side of the centre: $\frac{1}{2} \div 12 = \frac{1}{24} = \cdot0416$, and this is the tangent of 2° 23′. If your quadrant is divided into 180 divisions, each division equals 2°, and you can set it to half a division for single degrees, but cannot estimate minutes or parts of a degree. If you want an accurate taper, there is nothing for it but measuring the taper itself.—F. A. M.

Defects in Organ Pipes.—F. H. (*Newington*).—Pipes may speak the octave above their proper note by reason of being over-blown, in which case stop off some of the wind by closing in the hole in the foot; or the upper lip may require cutting a trifle higher, or may require pressing in or drawing out in the case of a metal pipe; or the languid may require raising or depressing. Try the first recipe before tampering with the mouth of the pipe, and look to see that there is no dust or other obstruction in the windway. Weak tones are occasioned by similar defects, but remember that both dulciana and stopped diapason are intended to give a quiet tone; indeed, the latter would be ruined by trying to make it loud. Try giving a little more wind, and the upper lip of the dulciana may require cutting up a trifle. See that the stoppers of the stopped diapason fit truly, and are placed squarely in the pipe. If they lean over, or are not air-tight, the tone will suffer.—M. W.

Wheel Cutting on "Go-Ahead" Lathe.—(*No Address*).—I am sorry to find I have made a mistake in the drawing on page 61; the worm, W, could not be got in as drawn. INDEX will probably have noticed this, and seen that he must either make the worm solid and of no greater diameter than the hole for screw A, or else B must be bored out large enough to pass the spindle through it, and a sleeve fitted in afterwards as a journal.—F. A. M.

Kitchen Fender.—G. T. (*Castletown*).—The following sketch of kitchen fender will, I think, meet your requirements The front is made of sheet iron, the top of steel bars. The shaped piece from A is usually cut out in one piece, and then welded on to the bar.—T. W.



Kitchen Fender Plan.

Paper Organ Pipes.—F. W. (*Sheffield*).—Paper organ pipes can be obtained from Mr. W. J. Burton, Organ Builder, Winchester. I presume that the lengths given by you are the tone lengths of the largest pipes in the respective stops, as, doubtless,

you know that the smallest pipe may be only about 3 in. long, whilst the 16 ft. tone can be obtained from a pipe 4 ft. long if it is a stopped pipe.—M. W.

Bible.—W. T. (*Bonnybridge*).—The leaves may be mended with tissue-paper and flour paste. Paste the edge of the tear and place a piece of tissue over it both sides, and when dry tear the tissue off again; this will leave a strip of tissue just where wanted. Let me know more definitely about the binding, and I will try and help you.—G. C.

Phonograph.—(*No Address*).—Your instrument seems to be all right so far as the construction is concerned, but your spring is too strong, and your needle certainly too blunt. Besides, I think that you screw the stylus, or needle, too far down, giving too much pressure upon the foil. Take note of these hints, and try again, and perhaps you may get better results.—W. D.

Dividing Rules, etc.—J. D. (*Poplar*).—A very fine graver is the proper tool to use, but you will require much practice before you can produce any satisfactory work, and can never approach the accuracy found in engine-divided scales.—F. C.

Varnish for Screen.—E. S. (*Liverpool*).—The rich dark polish and colour you have seen on writing desks, etc., can only be given satisfactorily to your screen by first darkening by means of stains, and finally French polishing. Varnish will not give so good a finish. You might try wiping over first with a weak walnut stain, and using just a tinge of red in your polish. An article, "How to French Polish," appeared in No. 105, March 21st; "The Rubber in French Polishing" in No. 108, April 11th. —LIFEBOAT.

Stained Floor and Wax.—TERPSICHORE.—To render your floor most suitable for dancing purposes, wax polishing is undoubtedly the best method extant, and if properly done, will not be "tacky," as you surmise, all tackiness being readily removed by finally wiping over with a piece of flannel, on the face of which has been sprinkled a little powdered French chalk; but for a large room it would be best to give the job to an experienced man, as it is laborious work in its first stages, though comparatively easy to keep in good condition afterwards. The fact that the floor is stained all over will make no difference if the present colour is suitable; otherwise, it must be done the right shade previous to polishing. Varnishing is often resorted to for the margins of floors, but cannot be recommended for the entire floor and the purpose you name. An article on Wax Polishing appeared in No. 52, page 826, from which you might glean many hints.—LIFEBOAT.

French Polishing Fillers.—S. S. (*Salford*).—The light oak may be oiled with clean linseed oil, and "filled in" by a mixture of finely-crushed whiting, just tinged with a little yellow-ochre, made the consistency of thick cream with turps or benzoline, rubbed well in crossways of the grain. For the satin-wood and maple you might omit the oiling first, also the ochre, using simply whiting mixed with equal parts of oil and turps; though for these light woods, including ash, some polishers use plaster of Paris and Russian tallow applied hot. This latter is a good filler, but its disagreeable smell prevents its general adoption; whilst others use plaster of Paris applied with a wet rag, and wiping off immediately: not left on all night, as I once saw done.—LIFEBOAT.

Theatrical Limelight Apparatus.—STAGE CARPENTER wishes to make a limelight apparatus for stage purposes. This may be said to consist of a wooden box of suitable size lined with metal, and mounted between a couple of standards attached to a base, something after the fashion of a toilet glass. A movable partition carrying a large size single condenser is made to slide into the box by means of grooves along each side, and a mixed limelight jet fitted to a tray moves along runners attached to the floor of the box immediately behind the condenser, connection between the gas bags and the jet being made by means of rubber tubing led through the back of the box, in a similar manner to an ordinary magic lantern. The coloured glasses (by means of which the varied tints are imparted to the light) slide into grooves immediately in front of the condenser. Some makers supply these coloured glasses mounted together on one circular disc or diaphragm, which is pivoted to the front end of the woodwork by means of a screw driven through a hole in the centre of the disc. This, of course, is very handy, as it does away with the chance of an accidental breakage. I will now describe a good useful form of limelight box, such as would be suitable for a 6 in. condenser. For the woodwork of the box (which should measure 10 in. by 10 in. by 12 in. when complete) obtain some *thoroughly dry* ½ in. or ¾ in. mahogany, preferably the leaf of a disused table, and proceed to carefully dress up three boards, each measuring 10 in. by 12 in.; and when ready, two of those which are to form the sides of the box should have a narrow groove run the way of the grain, at about 3 in. from one end, as shown in Fig. 2; after which, the three pieces are drawn for dovetailing, with the pins upon the floor or bottom piece. A narrow strip of the same wood, 10 in. by 3 in., which will also be required to form the top of the box, is merely intended for the purpose of binding the sides together, and should be placed across the top at 3 in. from the front end of the box, until just flush with the grooves, in which position it should be dovetailed to the sides. The framework can now be put together, with the grooves of the sides facing each other on the inside, using good glue for the purpose, and occasionally applying a square to the corners, in order that it may be got quite true. The base may now be prepared. For this, dress up a board to measure 11 in. by 14 in., and provide it with a couple of cross-ends, 11 in. by 2 in., which are screwed on in the manner shown in Fig. 3. A couple of standards, 9 in. long and 3 in. wide at the lower part, tapering to 2 in. at the top, are cut to the form of Fig. 4, and provided with dovetails, and next fitted into corresponding mortises prepared for their reception on opposite sides of the base; and before going further, it will be advisable to see if there is just sufficient room for the box to pass freely between the two standards. Returning to the box, a piece of ½ in. dry mahogany must be dressed up, and shaped and rebated on either side as shown in Fig. 5, until it slides smoothly along the grooves into the box; after which, a narrow slip of wood is nailed along the upper

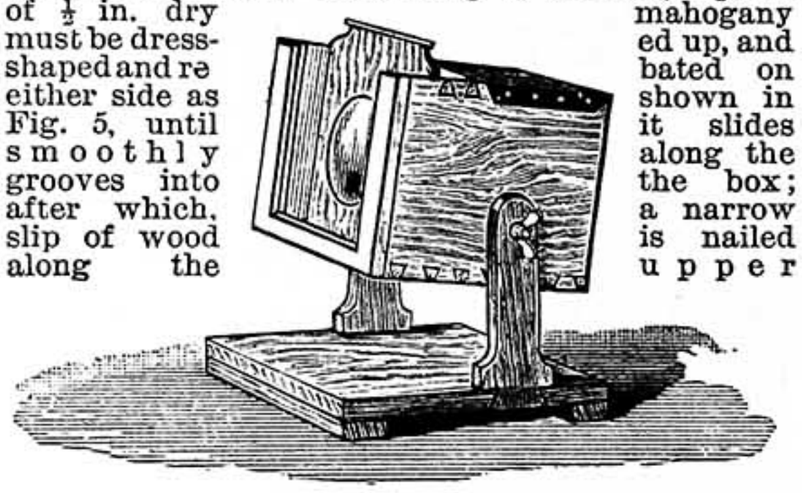


Fig. 1.

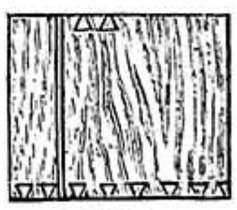


Fig. 2.

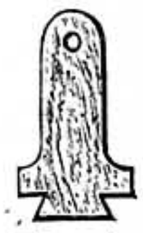


Fig. 4.

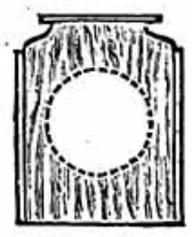


Fig. 5.

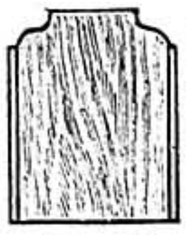


Fig. 6.

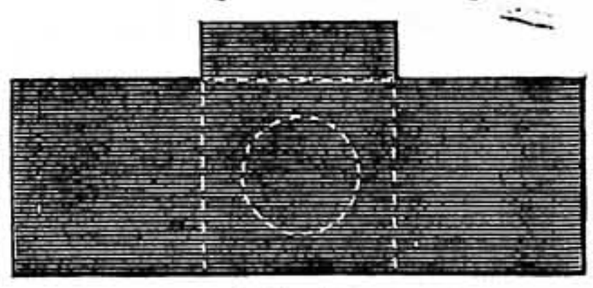


Fig. 7.

Fig. 8.

Fig. 3.

Theatrical Limelight Apparatus. Fig. 1.—Limelight Box. Figs. 2 to 8.—Component Parts of same.

edge of the shaped portion as a finish. A circular aperture is now cut in the middle of this board, in order to receive the condenser, being provided with a slight rebate, against which to rest the lens. When ready, the condenser is retained in the opening convex side outwards, by means of a ring of cane, which is sprung into the aperture against the glass, and then pinned to the wood. This arrangement is far preferable to having the lens fitted into a mount, as it will be less liable to crack. The woodwork is now completed by screwing a strip of rebated moulding round the front end of the box, thus forming the requisite grooves for the reception of the coloured glasses. The shutter, which is used for the purpose of obscuring the light when not required, may be made from a piece of thin ply fretwood (to be obtained at any fretwork emporium), cut to the form of Fig. 6, and made to slide in the same grooves as the coloured glasses. The box will now require to be lined with a piece of sheet iron or tin plate, 27 in. by 9 in., with a central flap, 3 in. by 9 in., cut to the shape of Fig. 7, and bent in such a manner that the central portion may come immediately behind the condenser, with the short strip above the central portion bent out to right angles, in order to cover the narrow strip of wood across the roof, the remaining portions of the metal being required to protect the two sides of the box. The lining is affixed to the woodwork by means of short nails driven through holes punched in the metal. We shall now require another strip of metal, 12 in. by 6 in., cut to the form of Fig. 8, for the roof of the box, which is also nailed to the woodwork through the two sides of the metal which lap over. The box may now be hung beween the two standards by means of a couple of bolts and fly nuts, inserted from the inside through holes cut through the metal lining of the inside of the box. It will thus be seen that the box can be retained in any desired position by tightening these bolts sufficiently. The remaining fittings, together with the management of the light, will be precisely the same as for an ordinary magic lantern, requiring the use of a mixed jet, and a bag each of oxygen and hydrogen gases under pressure, unless the compressed gas in cylinders is used, in which case an automatic regulator should be fitted to each bottle. Mr. Hughes, of 62, Mortimer Road, Kingsland, London, N., can supply 6 in. unmounted condensers, specially made for light boxes, at 16s. 6d. each. Also a special mixed jet at 12s. 6d.; any form of mixed jet will, however, answer as well. When a suitable jet has been selected, it will be needful to fit it on to an upright metal rod, attached to a board or shallow metallic tray, which is made to slide between a couple of grooved runners screwed to the floor of the box. Messrs. Cox & Co., 11, Fetter Lane, London, who advertise in the *Stage*, supply all requisites for theatrical limelight apparatus at low rates. The above firm quote coloured gelatine at 6d. per sheet, 7 in. square. This can be had in a great variety of tints, and may readily be mounted between a couple of sheets of glass of sufficient size in a wooden frame. The same firm also supply stained glass, mounted in frames, at prices ranging from 1s. 6d. to 2s. 6d. each. Messrs. Perken, Son & Rayment, of Hatton Garden, London, publish a little booklet at 6d. on the magic lantern, which will give you all the information you require on the management of the light, as the subject is one which cannot be treated at length in these columns; any special point shall, however, receive due attention.—C. A. P.

Thermometer.—A. X. E. (*Nottingham*).—Thanks for pointing out my mistake in stating, at page 828, No. 103, Vol. II., that in the construction of a thermometer the boiling point of water should *first* be marked upon the tube, whereas the authorities you quote show that the freezing point should first be ascertained and recorded. Please observe that in my reply to E. N., in the number of WORK alluded to, I wrote that I had never made a thermometer, and that I gave the substance of the best description I could lay hands on at the time. This was taken from a source which I have always found most reliable—viz., Spon's "Workshop Receipts," 1st series, page 432, being the last article in the volume. Upon referring to this now, I find that my abstract of the description was correct, as the words are: "Distilled water is made to boil, and the thermometer surrounded with the steam produced; the point to which the mercury rises is marked off with a file, *and the freezing point of water is also marked.*" As I said in my original reply, articles on "How to Make a Thermometer" will, without doubt, appear in WORK in due course, in which our readers will be fully instructed with regard to both theory and practice in the construction of this invaluable instrument.—OPIFEX.

Stain.—J. P. J. (*West Hartlepool*).—As you have only one sideboard you wish to darken, it is a question whether it would be worth the expense of making a special air-tight box in which to fumigate, especially as you say you have no room you could use for the purpose. Could you find such a room, or see your way clear to use the box for the same or any other purpose in the near future, it might be worth your while, as fumigation is pre-eminently the best plan to adopt, on the score of cleanliness and evenness of tone that is gained. You say bichromate of potash gives too red an appearance; this would be obviated by the addition of some walnut stain; or try either of the following: 1 pint liquid ammonia, 2 oz. Vandyke brown, 1 oz. bichromate of potash; mix 2 ox. pearlash and 2 oz. American brown potash in a quart of hot water. It may be well to remind you that it is always advisable to try the effect of these stains on odd pieces of similar wood to your sideboard, and thin down till you meet the desired shade, bearing in mind that the afterwards oiling, filling in, and polishing will, in all probability, make it a little darker still.—LIFEBOAT.

Rust from Japanned Iron.—M. M. (*Liverpool*).—The old japan will have to be scraped off with a plane-iron or similar instrument, and the surface scoured with dry grit-stone till the rust is completely taken out. If any rust is left it will be sure to spread, and again "throw up" the japan. As M. M. will probably have no convenience for the "storing" which black japan varnish or cycle enamel (which is in all material respects the same) requires, he will, perhaps, do as well to make shift with Aspinall's Enamel for re-coating his box, as he suggests.—S. W.

Compo. for "Scriptograph."—EASTWOOD.—The basis of all these "graph" compos. is glycerine and glue. That in question is composed of glycerine ½ lb., Russian glue, or gelatine, ¼ lb., water, and sulphate of baryta. The water is added to moisten as required; the sulphate of baryta is of no other use than to render the almost transparent mixture sufficiently opaque to show whether the writing has properly touched in every part; French chalk has sometimes been used instead. To prepare: first soak the glue, then put it into a jar standing in a saucepan of hot water; add water and glycerine, and when the glue is dissolved add the colouring matter (sulphate of baryta), and stir the whole together. When thoroughly mixed, pour warm into the shallow tin tray of the apparatus, and let it set. If it prove too hard, melt again with more water; if too soft and sticky, add glue. It is more than probable that the first one or two attempts will not be satisfactory. Or the compo. may be bought ready prepared from Messrs. Baddeley Bros., Chapel Works, Moor Street, London, E.C., at 2s. 6d. per tin.—S. W.

Staining and Book.—G. J. W. (*No Address*).—There are several books published treating of the subject. I have not seen one yet that can be recommended to the amateur, though Messrs. Wyman & Sons, 74, Great Queen Street, London, W.C., issue one in their Technical Series, "French Polishing," price 2s. 6d., which is of more service to the professional than embryo polisher. Far and away the best to be recommended to the learner is the series of articles comm resent

volume of WORK, the first of which, "How to French Polish," appeared in No. 105, March 21st, and "The Rubber in French Polishing," in No. 108, April 11th, to be followed by others besides. Had you read this paper closely, and the answers given in "Shop," you could not fail to have gleaned many useful hints. Have you no bookseller in your neighbourhood who would be glad to supply you with the numbers of "Natural History" you require? If not, write Messrs. Cassell & Co., asking for a classified catalogue of books, and stating your requirements.—LIFEBOAT.

Enamel Paint.—H. A. K. (*Bedale*).—The nearest approach to be obtained by self-mixing is to use a white enamel, or Bath, varnish, and add to it finely-ground tube colours. Ordinary paste paints are not sufficiently finely ground for the purpose; even the best white lead of ordinary paste form will dull and make gritty the enamel or varnish. If white is wanted, tube flake white can be used, from which tints of any colour can be made. See Index, Vol. I., for Picture-frame Compo.—F. P.

Gold Bronze.—J. D. (*London, E.C.*).—Gold bronze—viz., bronze powders—may be used in liquid form by making a solution of white stick lac in methylated spirit, and adding the bronze thereto. Sufficient only of the lac must be used to bind the powder, or the brightness of the bronze will be affected.—F. P.

Banjo Fittings.—P. Q. (*Denholme*).—Did you see advertisement in advertising columns for fittings? You can get ordinary fittings from Messrs. Dawkins, Charterhouse Street, London. The portable music stands (folding iron) are patented, therefore you could not make them. Even if you could buy the parts, they would very likely cost you as much as you could buy the stands for finished. If you write to Messrs. Harrow & Co., 13 and 14, Portland Street, Wardour Street, London, W., they will, no doubt, give you all particulars.—J. G. W.

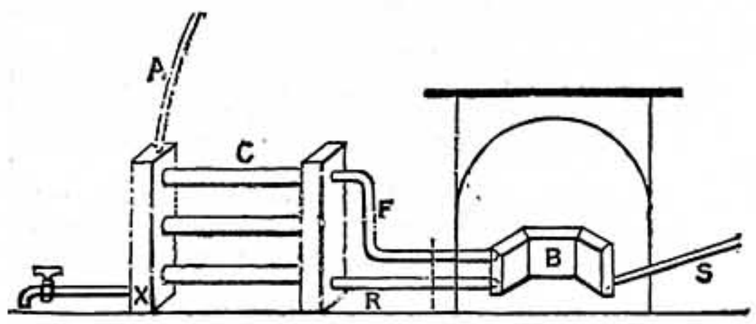
Electric Light for Dark Corner of Room.—W. B. E. (*Walsall*).—You will find full instructions on small electric lights in the articles published in Vol. II. on "Model Electric Lights" (see Nos. 76, 82, 89, 92, 94, 97, 99, 101, and 104). The little arrangement for a photographic dark room described and illustrated in No. 89, page 593, will just suit the purpose of persons like yourself, who wish to have a small light at the smallest possible cost.—G. E. B.

Strength of Electric Current.—LEARNER.—Your friend was quite right, but you have drawn a wrong inference from his statement, and have mixed up current strength with E.M.F., or current potential. The strength of an electric current is expressed in ampères, which represent the total volume of current obtainable through a given resistance when urged by a certain pressure or potential. We first of all take the potential, or electric pressure in the cells; this, in the battery you name, is 1½ volts each cell. To obtain 1 ampère of current from one of these cells, the total resistance of the whole circuit must not exceed 1½ ohms. If, then, the resistance of the motor is 1 ohm, and you get 1½ ampères of current through the motor, the resistance of the cell itself would be nothing. This course of reasoning is ridiculous, as the cell must have an internal resistance. Suppose it to be a large Leclanché cell, having an internal resistance of ¾ ohm: then the resistance of the cell will be ·75 ohm; the resistance of the motor 1 ohm: total, 1·75 ohms. Now, the E.M.F. of the cell is 1·50 volts. Divide the total E.M.F., 1·50, by the total resistance, 1·75, and we get ·85 ampère as the total strength of current. Now add another cell in series. The result will be $\frac{1{\cdot}50 \times 2 = 3{\cdot}00 \text{ volts}}{{\cdot}75 \times 2 + 1 = 2{\cdot}50 \text{ ohms}} = 1{\cdot}20$ ampères. If we take a smaller cell the internal resistance will be higher: say 1 ohm instead of ¾ ohm; then the result will be, $\frac{1{\cdot}50 \times 2 = 3{\cdot}00 \text{ volts}}{1{\cdot}00 \times 2 + 1 = 3{\cdot}00 \text{ ohms.}} = 1{\cdot}00$ ampère only. The consumption of zinc will be proportional to the ampères of current obtained, not the volts. The strength of current in ampères at the terminals of a secondary coil will be very small indeed, but the potential is enormously increased by the inductive effects of the coils of wire.—G. E. B.

Slipping of Driving Belts.—BELTING (*London*).—As I have not yet met with a good composition to prevent slipping of belts, I am sorry to say I cannot recommend one to you. All that I am acquainted with are injurious to leather belts, and more or less dirty in use. I am, therefore, an unbeliever in the efficacy of belting compositions. The supposed necessity for their use arises out of bad arrangements for driving the machines. If belts of the right width, made out of best raw hide leather, well oiled, are employed in the first instance, and the pulleys are properly proportioned, there will be no slipping of the belts, providing, of course, they are not too slack or too tight. If you will give me full particulars respecting the driving arrangements of your dynamos, I will endeavour to advise you how to prevent slipping of the belt.—G. E. B.

Indiarubber Substitute.—G. A. & Co. (*Stockport*).—We do not find any patent issued for the material mentioned under the name given. So far as we have learned, it was a failure, and did not fulfil what it was proposed to do. We are unable to give the address, not having been able to ascertain it, and from what we can learn, little benefit would be derived from it were we able to do so.—C. E.

Portable Coil.—W. A. T. (*No Address*).—If you mean an ordinary coil, such as is used to warm an entrance-hall, staircase, and so on, which is constructed of cast-iron or copper pipes, and is heated from a boiler in another part of the building, I say, "No, it is not practicable," as I presume you want to take it from one room to another; and there are various reasons why this could not very well be done. I do not say it is impossible. I send you a sketch showing how it *may* be done. B is the boiler, which is placed on the stove to form the



Small Coil heated from Register Grate. B, Boiler, taking place of Fire-bricks. F, Flow-Pipe. R, Return-Pipe. C, Coil. A, Air-Pipe. S, Supply-Pipe. The dotted lines show where Valves would have to be put if Coil is to be removable.

fireplace; C is the coil, which may be in the same room, a room adjoining, or a room beneath. The flow-pipe goes in at the top, and the return comes out at the bottom. If this coil is to be fixed so as to be removable at any time without disturbing the pipes, and so that it can easily be put back again, a screw-down stop-valve must be put in each pipe, with a connector in each pipe on the coil side of the taps. Some provision would have to be made to run the water out of the coil after the valves are turned off, before disconnecting—say a short piece of pipe with a tap at X. Water to supply the coil could either be taken to the boiler from a supply cistern, or the coil boxes could have loose covers, so that water could be poured into them occasionally, the waste from evaporation being small; in this case no air-pipe or tap would be required. Rippingilles—the oil-stove people—make several hot-water arrangements for use with their stoves; and probably one of them would answer your purpose better than the above, which, though movable, can scarcely be called portable.—R. A.

A Doll's House.—H. M. (*Hunsdon*).—Many family men are numbered among our readers, as is evidenced by the numerous applications received for designs of cots, bassinettes, etc., and, in the present instance, a doll's house. Overcrowded space prevents much from being said concerning constructive details, therefore, a great deal must be

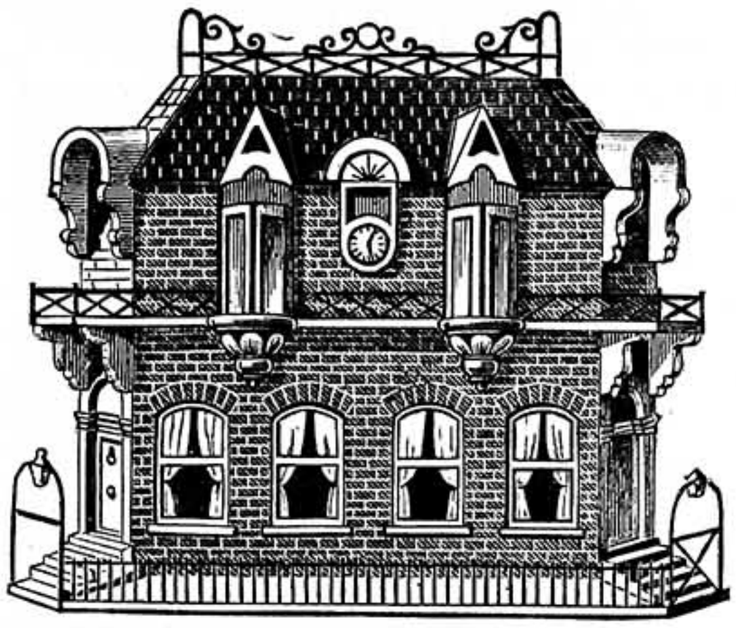


Fig. 1.

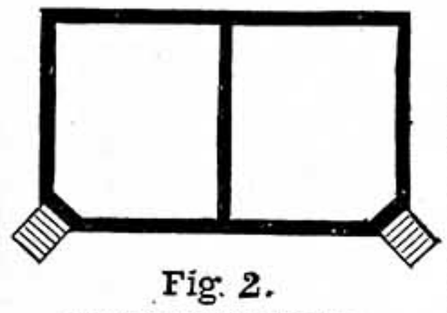


Fig. 2.

Model Doll's House.

left to the reader's judgment and opinion. In this design I have studied simplicity of construction; and sufficient opportunity exists for carrying out ornamental details to an unlimited extension. A ground plan is shown in Fig. 2, in which is indicated what I consider to be the best positions for doors. If these ends are fitted merely with windows, with the balcony also returned along them, such should suffice for effect. It will be preferable to make a rough cardboard model as a preliminary object of ascertaining the proper proportions and shapes of the various parts. The roof and its adjuncts will be found the most difficult part to construct. If a partially flat roof is adopted, the possessor of the house will value it the more. I would suggest that instead of carrying the ends entirely to the top as doors, the roof should open flap-wise, and the upper storey of the house be fitted as a work-box. You are going to make one 3 ft. high with four rooms; but, as will be understood, the design is not confined to one particular enlargement.—J. S.

Flute Cases.—S. G. F. (*Chiswick*).—The flute cases used by the bandsmen of the Guards' Drum and Fife Band are made of the best bleached buff, and are hand-sewn. They cost about 12s. 6d. each, but lower-priced ones are procurable. Apply to Messrs. Silvani, 45, Wilson Street, Finsbury.—G.

Circular Rails.—F. B. H. (*Wolverhampton*).—The smallness of diameter of the rail track will be limited by the amount of clearance you can give the flanges, and this will depend upon the width of the wheel treads, which you do not mention. If there were no play between the flange and rail a straight track would be necessary. Your simplest course is to make a short piece of track of stout tin plate, and so determine experimentally the shortest radius at which the flange of the leading wheel will not mount the rail. The outer rail should be raised slightly above the level of the inner rail, to counteract the tendency of the engine to fly off by centrifugal force. To find the necessary super-elevation of outer rail in inches above the inner rail, multiply the gauge of rails in inches by the square of the speed in miles per hour, and divide the product by the radius of track in feet and by seventy-two.—F. C.

Beam Engine.—J. B. (*Edenfield*).—Consult carefully the Indexes to Vols. I. and II. of WORK now published, and if there is no answer to your questions, kindly repeat them.

Castings.—CORINTHIAN.—Special tools must be made to suit special tasks. Generally speaking, those used by engravers, and also the metal shapes and burnishers used by fitters, are suitable. They are employed in similar fashion.—J.

Engraving Drawing Instruments.—DRAUGHTSMAN.—I recommend you to put them into the hands of an experienced engraver, who will do justice to them. Another way is to have them etched, for details of which please refer to No. 84, Vol. II., of WORK. You will find something about "Engraving on Metal" in Nos. 33 to 48, Vol. I. The special Exhibition Number is *not* intended to be bound in the case supplied by Messrs. Cassell & Co. for the ordinary volume of WORK.—N. M.

Transfers for Coach-Work.—(*No Address*).—The leading artist herald painter of the coach trade is Mr. John Sneath, Herald Painter, of Grantham, Lincs.; he is reliable for accurate delineation and work of the highest class in transfers. Leigh Anderton, Heraldic Artist, is also a first-class transfer artist; his address is 67, Vine Street, Manchester. For plain decorative work in transfers and herald-painting transfers, Charles Witham, 22, Grove Street, Lisson Grove, N.W.—J. C. K.

Setting a Razor.—K. L. (*No Address*).—If K. L. will kindly hunt up No. 100, Vol. II., of WORK, and turn to "Shop," page 782, he will, I think, find all he wants to know on the above subject, though rather condensed. Two of the sketches might have been plainer, but I have no doubt it was owing to want of space. The razor is laid flat on the stone, and when holding the handle with the right hand, three or four fingers of the left should press the razor pretty strongly on the stone during the period when the sharp edge travels first—that is to say, just the opposite to the method of stropping. When returning for another stroke the pressure should cease entirely, or almost so.—P. B. H.

Painting Mottoes on Carriages.—H. W. (*Strabane*).—The fine work of heraldry is, like miniature painting, done with suitable brushes. The mottoes being simply conventionally imitative in execution, are not difficult with panels in good position for light and work. The subtle touches which shall give character to a face, or display a definite expression to animal form and aspect, is real art, and requires more careful selection of brushes than for motto writing. Sable brushes are used, being stiffer for touch than camel-hair, which serve best for surfaces or lines in the arms. Pens cannot be used with oil paints effectively. Major Middleton, a most successful artist for limning the character in the face of his study for a portrait, had a very small picture to execute, which required the high lights to be well marked, as in heraldry they are invariably done. He came for a day's shooting to the writer's land, "in search of his tools," he said; that was two fine and very small feathers, to be found only in the pinions of the woodcock. They are very fine pointed, with very slight flexibility, and just that imbrication of feather which will take up a pigment and release it easily, even to the smallest dot ever wanted in miniatures; they serve this purpose, and none other, in artists' work.

Woodcock's Feather.

How to make a Greenhouse.—WHEELBARROW.—In Nos. 12, 14, and 16 of WORK you will find the construction of a greenhouse thoroughly and practically dealt with.

Grinding Scissors.—W. B. (*Penna, U.S.A.*).—We have not the address of H. F., the reader to whom you wished us to send on your sharpener.

Mathematics.—F. K. (*Oldham*).—Write to Messrs. Cassell & Co., Publishers, London, E.C., for their list of school books.

Bow-Hairing.—J. B. (*Leicester*).—This subject requires a short paper, with illustrations.—B.

Violoncello.—NO NAME (*Glasgow*).—Send through the Editor, prepaid, a pencil outline of the instrument you intend to make, and I will give the thicknesses and measurements you ask for.—B.

Electrical Measurements.—E. G. (*London, N.*).—The volt is the recognised unit of electric current pressure, and is roughly represented by the difference in potential between the zinc and copper

elements in a Daniell cell. The ohm is the recognised unit of resistance to the electric current, and is roughly represented by 6 ft. of No. 36 pure copper wire. The ampère is the recognised unit of electric current volume, and is represented by the quantity of current forced through 1 ohm of resistance by 1 volt of current pressure. For exact measurements, there are measuring instruments constructed to measure the current pressure and the resistance. To find the resistance of a Leclanché battery, you will need a delicate galvanometer—*i.e.*, current indicator, a set of resistance coils, and a Wheatstone bridge. The bridge will correspond with the beam of a balance; the resistance coils will represent the weights; and the galvanometer the index pointer of the balance. The resistance of the battery is balanced against the known resistance of a number of the coils. A detailed account of the process would occupy too much space in "Shop." In answer to your other questions:—(1) Supposing each cell of a Leclanché battery gives a current pressure of 1½ volts, and each cell has an internal resistance of $1\frac{1}{16}$ ohm, then the ampères of current obtainable from any number of cells placed in series will equal the total voltage as multiplied by the number of cells, *when divided* by the total resistance of all the cells and all the conducting wires. (2) The resistance is known by balancing it against a known resistance by means of the instruments mentioned above. (3) You will now see that resistance is a factor apart from current pressure and volume, as expressed by volts and ampères, therefore your third question means nothing at all. —G. E. B.

Dressing Tarpaulin Sheets.—A. W. T. (*Willesden New Junction*).—We apprehend A. W. T. wants to dress already made what he terms tarpaulin sheets which have been in use. Now, before we can give him any useful information on the subject he must let us know what kind of sheets he refers to, as although nearly all waterproof sheets or covers are, in common parlance, called tarpaulins, it is by no means a fact that one in a hundred is a "tarpaulin"; and unless we know exactly what kind of sheets he refers to, might give him quite wrong information, which we are by no means desirous of doing. In order that A. W. T. may see and understand what we mean, he must remember that in one class the waterproof qualities are obtained by means of a medium which is coated *on* the surface; in another class they are obtained by a material placed or included *between two* surfaces; and in the other by means of a material which *permeates* entirely through the whole of the material forming the sheet. A. W. T. must understand that what produces the desired effect in each particular case would cause entire failure and injury if applied to either of the others.—C. E.

Taking out a Patent.—F. S. S. (*Leicester*).—No invention patented in this country can be made abroad and imported by any foreigner or Englishman during the duration of the English patent. Of course, when the exclusive right has expired, it can be made by anybody anywhere, and imported or exported, as may be the case. It is perfectly free for a foreigner residing in any country where the invention has not obtained exclusive privileges to manufacture and sell the invention; but he cannot sell in or send them to any country where the inventor has obtained an exclusive privilege. There is no such thing as "protection," in the sense in which it exists in England, in any of the foreign countries. In these you have to apply for the grant of a patent, and deposit a complete specification, claims, and drawings, with the application; and when the patent is granted you have then got your rights and protection. The cost of all this entirely depends on the work to be done, the time it occupies, the cost of meeting the objections raised by examiners—most particularly in the case of the two latter countries named—and various other points connected with the work. We would advise F. S. S. to refer to, and read and study, the article on this subject in WORK, No. 44, Vol. I., p. 694; also the reply to R. W. S. (*Leeds*), in No. 109, Vol. III., p. 77.—C. E.

Reproduction of Draughtsman's Drawings.—ON TIME.—To reproduce drawings in the manner required by ON TIME, the drawings have to be traced on what is known as autographic transfer-paper with a peculiar ink, and then transferred to the plate, from which any number may be printed. We do not gather from the query whether it is desired to know the *modus operandi* of the process, or whether it is simply desired to know what is the best ink for the purpose. Lithographic or chemical ink may be used, which should be rubbed dry on a clean porcelain saucer until sufficient is rubbed off. Then add water, drop by drop, until sufficient is added to make it, when rubbed with the finger, of a deep black colour, and liquid enough to flow evenly from the drawing pen; but it will not do if it is at all "watery." Great care must be taken to keep it perfectly free from dust when in use, and if it is allowed to become dry it should be thrown away, and a fresh lot mixed, no satisfactory results being obtainable by re-mixing.—C. E.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Windmill Sails.—TURNER writes:—"Can anyone tell me the length (from axle to end of whip) and breadth of windmill sails to develop at twenty revolutions per minute—1st, 5 h.-p.; 2nd, 10 h.-p.; 3rd, 15 h.-p.? Also I shall be glad of a sketch showing action of and method of coupling up of louvre-board rods. Average velocity of wind, twenty miles per hour. I give number of revolutions per minute and velocity per hour as two foundations to calculate horse-power on. I hope I am sufficiently clear."

Oak Mouldings.—T. J. J. (*Tottenham*) writes:—"Will any reader kindly inform me where I can obtain small oak mouldings and beadings, suitable for a small bookcase, about ½ in. or ¾ in., anywhere round Shoreditch or the City?"

Thin Lines in Fretwork.—PUZZLE wants to know how to cut in fretwork very thin lines in the middle of a design. If he bores a hole, it makes the work look ugly at once.

Glass Writing.—E. E. D. (*Crewe*) writes:—"Can anyone inform me where to obtain a book on glass writing and embossing; also, how to mix isinglass and spirits of wine as used for size for gilding on glass?"

Fan Blowers.—W. H. (*Motherwell*) writes: "I shall feel obliged to any reader who will give me full particulars and dimensions of a useful set of fan blowers."

Preservative for Outdoor Polished Brass.—P. H. (*London*) writes:—"Can any reader tell me a simple recipe for preserving a brilliant polish on outdoor brass-work (handsome knockers and letter-box plates on front doors)? I have tried several kinds of enamel and lacquers, including 'Silicon,' but to no purpose, although it answers for indoor work. I have used a special preparation of vaseline, but it spoils the gloves and greases the hands of those who have to use the knockers, etc., and, besides collecting dust and dirt, it shows tarnish in a fortnight, and wherever the fingers have touched it it turns black in an hour. I have not time to spend a half-hour every day to clean them with polishing paste; besides, if then left two or three days, they get so black that it takes three hours or more to clean, only for them to go black again in two or three days."

Fire Balloons.—E. D. R. (*Brierley Hill*) writes:—"(1) Will any reader kindly inform me how to make coloured fire to illuminate the bottom of fire balloons? (2) How to fix same? (3) The probable cost?"

Letter-Press Printing.—W. A. D. (*New Brompton*) writes:—"Would anyone inform me where I could obtain (and the price of) a good practical work on Letter-Press Printing?"

Air Pump.—A. T. (*East Greenwich*) writes:—"Will any reader of WORK tell me how to make a pump for pumping air, and show diagrams in 'Shop?'"

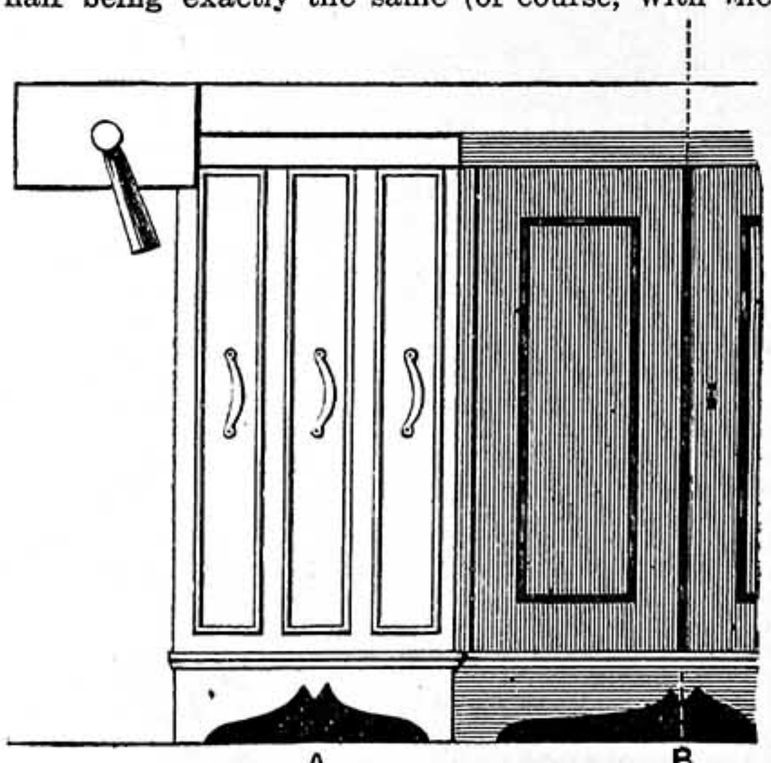
Air Cushion.—H. R. (*Clapham*) writes:—"I have an air cushion which has a slight leak. Can any reader inform me how I can find out where it is, so as to repair same?"

Fret Clock Design.—H. O. H. (*Bristol*) writes: "Will any reader of WORK tell me where I could obtain a good clock design for fretwork, either Italian or French preferred? Also where I could obtain a catalogue of French miniature designs?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Petroleum Motors.—THE BRITANNIA COMPANY write:—"In reply to CONSTANT READER (see page 142, Vol. III.), petroleum motors cost more for fuel than gas or steam-engines, except in districts where petroleum is produced. In towns where gas is above 5s. per 1,000 the difference is not so important. There are two good petroleum engine makers who supply various sizes."

Combined Bench and Tool Chest.—F. A. (*No Address*) writes:—"In reply to T. R. B. (see page 142, Vol. III.), I send a design for a combined bench and tool chest. The drawing shows one half, the other half being exactly the same (of course, with the



Combined Bench and Tool Chest.

omission of the vice). All patterns of tool cabinets, as at present made—*i.e.*, with cupboards at the ends—require about 1 ft. 6 in. extra space at each end to allow for opening. This is obviated by having slides at A (which are really three drawers turned on end, and with racks for tools). Of course, these do not require any room at the end, which, as T. R. B. requires one end of bench to stand against wall, could not be spared. A B is a cupboard, set back about half the width of the bench, for large tools, glue-pot, etc. The lower portion should be made in three carcases, screwed to the top of bench and to each other, to allow of easy removal."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—ST. MUNGO; J. D. (*Glasgow*); I. R. C.; H. W. (*Bristol*); J. A. (*Perth*); GLEVUM; F. H. H. (*Wednesbury*); J. W. N. (*Gateshead*); A NEW READER; E. J. S. (*Leighton*); A. F. L. (*Manchester*); REDOLIFFE; H. H. (*Birmingham*); SAINT VALENTINE; A. B. (*Salford*); J. S. T. (*Southampton*); IN THE TIMBER; J. S. (*London*); A READER; F. W. B. (*Sunderland*); T. C. (*Belfast*); J. M. (*Wolverhampton*); J. G. (*Nottingham*); DYKEHOUSE; E. W. N. (*Leicester*); A. W. (*Paisley*); PAINTBRUSH; E. A. P. (*Tullow*); R. S. (*Gloucester*); T. J. (*Somerset*); J. F. (*Preston*); S. (*Westminster*); WORKONIAN; W. O. (*Stanningley*); WALLSEND; GREENHORN; G. H. B. (*Liverpool*); ANXIOUS; H. F. (*Wigan*); N. E. D.; H. E. (*Hampstead*); J. H. M. (*Manchester*); R. S. (*Oldham*); J. G. J. (*Glasgow*); A. M. (*Coundon*); GRAFTON; F. P. (*Newport*); NOVICE; J. K. (*Liverpool*); W. G. (*Blackburn*); H. B. (*Melbourne*); W. P. & Co. (*St. Philip's*); G. D. O. (*Oldham*); J. H. W. (*Bath*); J. J. R. (*Southampton*); WORKITE; J. B. (*Earlestown*); J. S. (*East Barry*); W. W. (*Penrith*); W. A. L. & Co. (*Birmingham*); J. M. B. (*London, W.*); J. A. (*Peterhead*); W. R. (*Hackney*); W. D. (*Newington Butts*); NOVICE; W. H. (*Penwalton*); OILY; TIN; H. R. (*Manchester*); A. H. W. (*Newcastle-on-Tyne*); L. B. (*Marylebone*); M. H. (*Higher Walton*); J. H. W. (*London, N.E.*); W. J. P. (*Jersey*); J. O. H. (*Wandsworth Common*); L. L. (*Nottingham*); W. W. (*Chelsea, S.W.*).

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Water Motors, from 5s.; ½ h.-p., price 20s. List free.—WALTON, 9, Queen Anne St., Stoke-on-Trent.